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FRACTURE MECHANICS DATA FOR 2024-T861 AND 2124-T851 ALUMINUM

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by

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25 October 1974

Prepared under Contract NAS9-13583

"Development of Fracture Mechanics Data
for 2024-T861 and 2124-T851 Aluminum Alloys"

for the period

29 June 1973 to 15 September 1974

by

McDonnell Douglas Astronautics Company

St. Louis, Missouri

for

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Lyndon B. Johnson Space Center

Houston, Texas 77058



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16. Abstract The fracture toughness and fatigue flaw growth characteristics of 2024-T861 and 2124-T851 aluminum were evaluated under plane stress conditions. Center cracked tension specimens were employed to evaluate these properties under a number of different test conditions which included variations in specimen thickness, specimen orientation, test environment, and initial flaw size. The effect of buckling was also investigated for all tests of thin gage specimens, and the effect of frequency and stress ratio was evaluated for the cyclic tests. Fracture toughness test results were analyzed and presented in terms of fracture resistance curves; fatigue flaw growth data was analyzed using empirical rate models. The results of the study indicate that both fracture toughness and resistance to fatigue crack growth improve with increasing temperature and decreasing thickness. The presence of buckling during testing of thin gage panels was found to degrade the resistance to fatigue flaw growth only at elevated temperatures. Variations in cyclic frequency over the range 20-200 cpm had no observable effect on fatigue flaw growth. The toughness values obtained from toughness testing did not agree with those indirectly obtained from the cyclic data by curve fitting the empirical rate models; however, such differences are attributed to the lack of sufficient data at the high ΔK levels preceding instability.			
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FOREWORD

This report was prepared by McDonnell Douglas Astronautics Company - East (MDAC-E) under NASA-JSC Contract NAS 9-13583, Development of Fracture Mechanics Data for 2024-T861 and 2124-T851 Aluminum Alloys.

The work reported herein was accomplished under the direction of Mr. Royce G. Forman of the Structures and Mechanics Division of the Lyndon B. Johnson Space Center, National Aeronautics and Space Administration. Mr. L. J. Pionke was the Program Study Manager for MDAC-E; Mr. R. K. Linback assisted in data analysis and preparation of the final report. Mr. K. C. Garland conducted the majority of the laboratory testing and developed the many techniques that enabled the experimental work to be conducted smoothly and efficiently. The authors wish to gratefully acknowledge the assistance of other laboratory personnel, namely R. W. Bill, J. J. Slavick and R. E. Whaley, who assisted in many ways throughout the program.

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NOMENCLATURE

- a = Half crack length
2a = Crack length
B = Specimen thickness
C = Specimen compliance
COD = Crack opening displacement
E = Elastic modulus
 F_{ty} = 0.2 per cent offset yield strength
K = Stress intensity
 K_c = Plane stress or mixed mode critical stress intensity
 K_{Ic} = Plane strain critical stress intensity
 K_I = Applied stress intensity
 K_R = Stress intensity relating stable crack extension
and applied load for a given material
 ΔK = Stress intensity range for a fatigue cycle
 ΔK_o = Threshold stress intensity range for fatigue crack
propagation
 l_e = Effective total crack length
N = Number of applied fatigue cycles
P = Applied load
R = Stress ratio for a fatigue cycle
= $\sigma_{MIN}/\sigma_{MAX}$
r = Residual
= Difference between the calculated and measured values
of the dependent variable
t = Specimen thickness
w = Specimen width

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NOMENCLATURE (Continued)

z = Finite width correction factor

$= \sec (\pi a/w)$

σ = Applied stress

σ_n = Net section applied stress

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Section 1 INTRODUCTION

Much of the Space Shuttle primary structure will use 2024-T861 aluminum sheet because of its proven history in the aircraft and aerospace industry, its inherent high strength at room and elevated temperatures, and its resistance to stress corrosion cracking. The newer and higher purity version of the alloy, 2124, offers the same basic properties plus improved short transverse ductility in thick plate sections.

Fracture mechanics design data is of prime importance in the Fracture Control Plan for the Space Shuttle. In order to establish damage tolerances and to select proper operating stresses for a safe-life structure, a knowledge of the fracture toughness and fatigue crack growth rate values for through-the-thickness cracks under plane stress conditions is essential. Even though the 2024-T861 alloy has been reasonably well characterized for aircraft use, additional data must be generated to encompass the wider operating temperature range, the higher operating stresses, and other mission environments for the Shuttle vehicle. Fracture mechanics theory, although considerably advanced from a decade ago, still lacks the predictive capability to handle a wide range of thicknesses, cyclic frequency, operating temperatures, environments, and stresses and stress states relative to fracture toughness and cyclic crack growth rates.

The primary objective of this program was to generate fracture mechanics data for 2024-T861 sheet and 2124-T851 plate materials. Both the fracture resistance and the cyclic crack growth behavior of these alloys were evaluated using a

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variety of test variables, including specimen thickness, specimen orientation, test environment, initial flaw size/maximum applied stress, and restraint (thin gage only). Variations in frequency and stress ratio were also investigated for the cyclic tests.

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Section 2 PRELIMINARY MATERIALS CHARACTERIZATION

2.1 MATERIALS

The materials for the present program were all procured against current McDonnell Douglas material specifications, which meet the chemistry and strength requirements of Federal Specification QQ-A-250 for 2024 and 2124 sheet and plate. Detailed information on the materials is summarized in Table 2-1.

2.2 SPECIMEN MANUFACTURE

The smooth tensile specimen shown in Figure 2-1 was used for determining the baseline mechanical properties for each alloy/thickness combination. The thickness of all 2024-T861 specimens was identical to that of the as-received sheet. The 2124-T851 specimens were machined from the 50.8 mm (2.0 inch) thick plate to a thickness of 6.35 mm (0.250 inch); the thickness dimension of these specimens was parallel to the short transverse direction of the plate. All specimens were selected so as to supply information on the mechanical properties of each sheet or plate of material used; for the 2124-T851 alloy, specimens were also selected to monitor any variation in properties through the thickness of the plate.

The center cracked tensile specimen shown in Figure 2-2 was used for both fracture toughness and cyclic flaw growth testing. A special tooling jig, shown in Figure 2-3, was fabricated in order to ensure that the flaw and loading holes were positioned symmetrically with respect to the centerline of each specimen. For the 2024-T861 specimens, appropriate size blanks were sheared from each sheet of material and then finish-machined using the tooling jig. For the 6.35 mm

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Table 2-1

SUMMARY OF SUPPLIER'S INFORMATION

	2024-T861			2124-T851
SUPPLIER:	REYNOLDS			ALCOA
APPLICABLE SPECIFICATION:				
<ul style="list-style-type: none"> ° MCDONNELL DOUGLAS ° MILITARY 	MMS 1408 QQ-A-250/4			MMS 149 QQ-A-250/29
HEAT TREATMENT * :				
<ul style="list-style-type: none"> ° SOLUTION TREATMENT ⁽¹⁾ ° STRESS RELIEVED ⁽²⁾ ° AGING TREATMENT 	766°K (920°F), WQ COLD ROLLED 464°K (375°F)/8 HOURS			766°K (920°F), WQ COLD STRETCHED 464°K (375°F)/12 HOURS
SIZE:				
<ul style="list-style-type: none"> ° THICKNESS (mm) (in) 	1.60	3.18	6.35	50.8
	.063	.125	.250	2.000
<ul style="list-style-type: none"> ° WIDTH (cm) (in) 	122	122	122	122
	48	48	48	48
<ul style="list-style-type: none"> ° LENGTH (cm) (in) 	366	366	366	244
	145	144	144	96
QUANTITY:	7	7	4	6

* As specified in Reference (2-1)

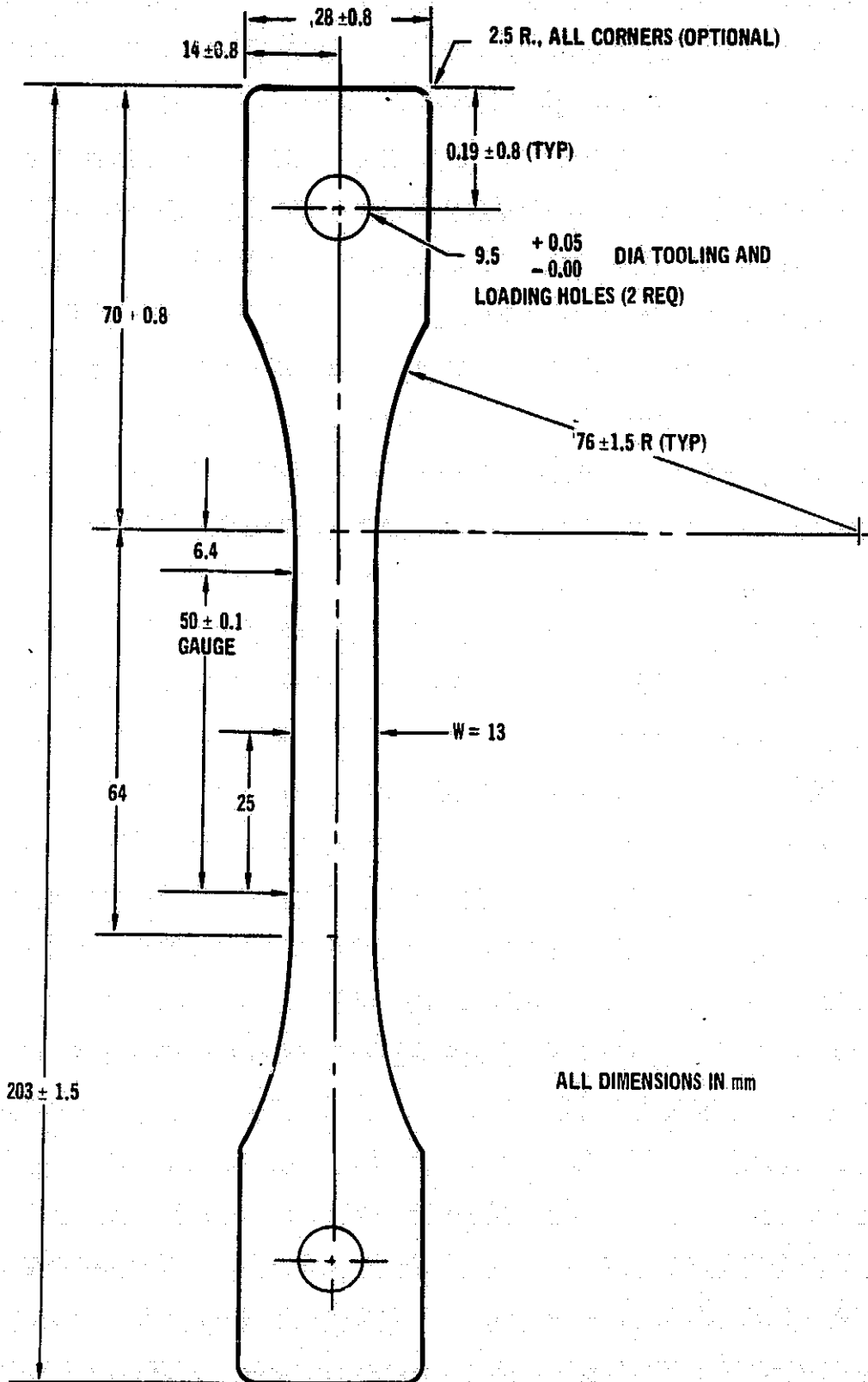
1 WQ: Water quenched

2 1.5-3.0 percent deformation

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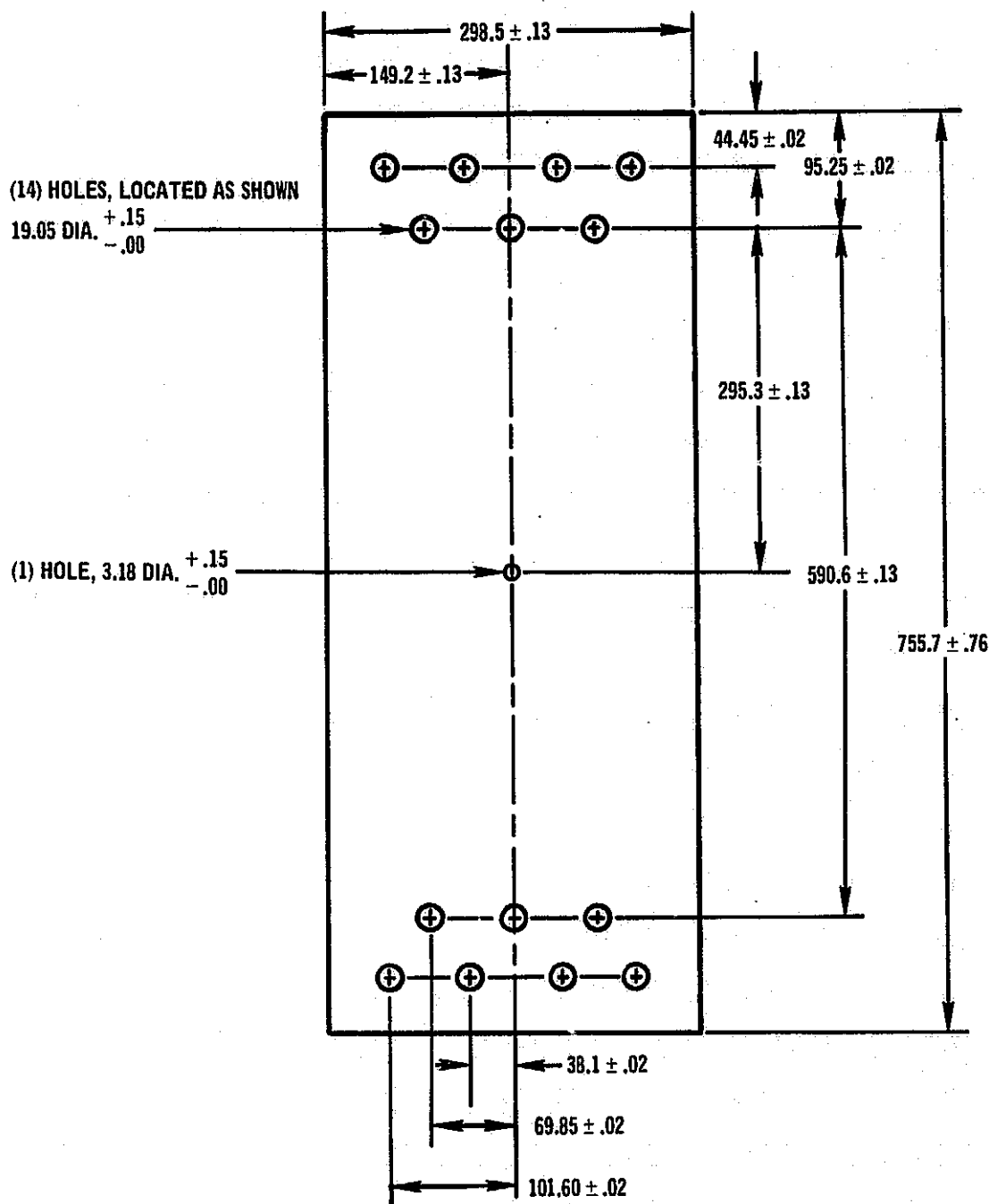


TENSILE SPECIMEN CONFIGURATION

FIGURE 2-1

FRACTURE MECHANICS DATA FOR 2024-T861 AND 2124-T851

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ALL DIMENSIONS IN MM

FRACTURE TOUGHNESS/FATIGUE SPECIMEN CONFIGURATION

2-4

FIGURE 2-2

MCDONNELL DOUGLAS ASTRONAUTICS COMPANY • EAST

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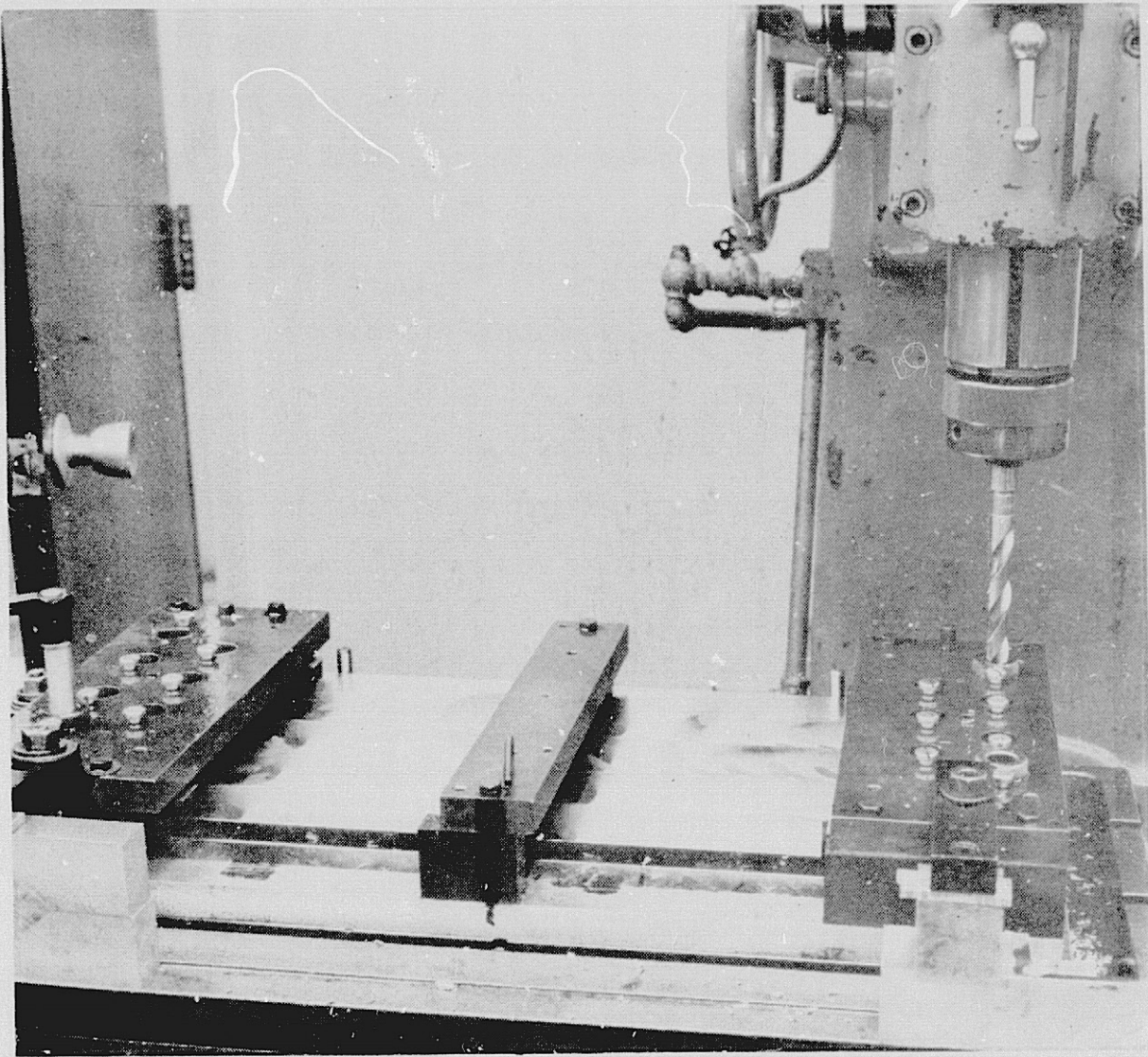


FIGURE 2-3
TOOLING JIG FOR SPECIMEN MACHINING

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(0.25 inch) thick specimens to be tested at high stress levels, doublers were resistance welded onto the specimen grip areas in order to prevent bearing and tensile failures in the regions surrounding the loading holes.

The 2124-T851 specimens were machined by first sawing each 50.8 mm (2.00 inch) thick plate into blocks having the required specimen length and width dimensions.

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These blocks were then sliced perpendicular to the short transverse direction of the plate using a band saw equipped with a carbide-tipped blade. As many as four specimens could be sliced from one 50.8 mm (2.00 inch) thick block; therefore, in order to maintain the surface of each specimen parallel to that of the original plate, the cut surface of each sliced block was milled parallel to the unsawed surface before another slice was made. A Hydrotel high-speed milling machine equipped with a flycutter (Figure 2-4) was used for this phase of machining; a special vacuum fixture was fabricated to hold and prevent flexing of the specimen block during this milling operation. For the 2124-T851 specimens to be tested at high stress levels, the thickness of the grip area was increased as necessary to prevent failure through the loading holes.

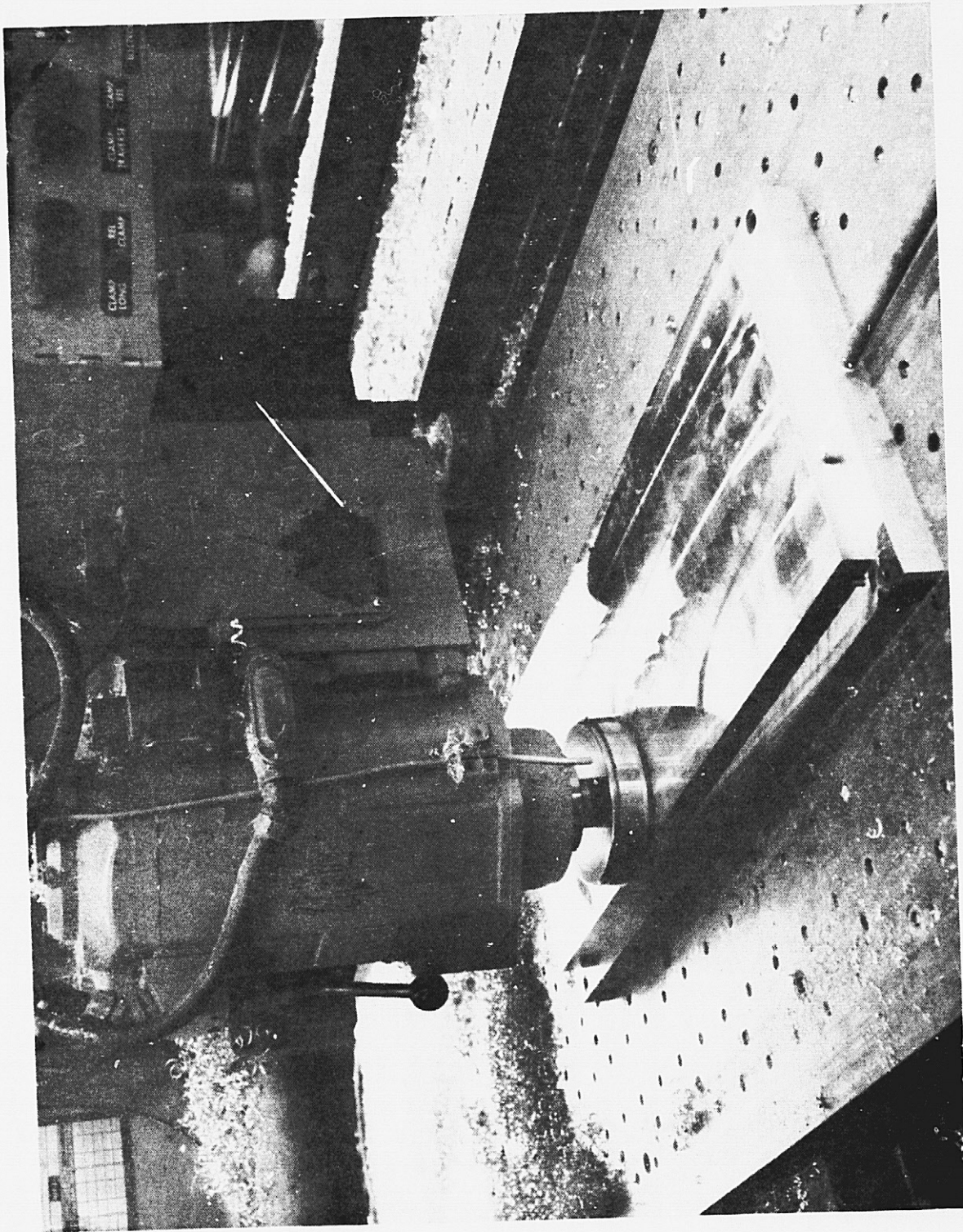
2.3 PRELIMINARY MATERIAL CHARACTERIZATION

In order to establish the baseline mechanical properties of each alloy/thickness combination, a total of 72 tensile tests were performed according to the schedule given in Table 2-2. All tests were performed in accordance with ASTM E8-69, Standard Methods of Tension Testing Metallic Materials. These tests were conducted on a Satec universal testing machine having a capacity of 133,000 N (30 kips). Prior to testing, each specimen was fitted with an ASTM Class B-1 extensometer. When necessary, a Conrad-Missimer environmental chamber was used to achieve the required temperatures. This chamber is a circulating air oven, with provisions that also permit the introduction of coolant (e.g., liquid nitrogen) and the attachment of the specimen to the loading train of the testing machine. For these tests, temperature was controlled to an accuracy of $\pm 2.8^{\circ}\text{K}$ ($\pm 5^{\circ}\text{F}$) by taping a thermocouple to the specimen gage length. Once the desired test temperature was achieved, each specimen was held at this temperature under zero load for 10 minutes to achieve thermal equilibrium. During testing, a strain rate of .005

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SURFACE PREPARATION OF 2124-T851 SPECIMENS SECTIONED FROM 5.08 CM (2.00 INCH) THICK PLATE

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Table 2-2

TENSILE TEST MATRIX

	2024-T861	2124-T851
TEST DIRECTIONS*	L, T	L, T
THICKNESSES, mm	1.60, 3.18, 6.35	6.35
in	0.063, 0.125, 0.250	0.250
TEST TEMPERATURES, °K	144, 298, 450	144, 298, 450
°F	-200, 70, 350	-200, 70, 350
TOTAL NUMBER OF SPECIMENS	54	18

*L: Longitudinal direction; load applied parallel to rolling direction of sheet or plate

T: Transverse direction; load applied perpendicular to a rolling direction of sheet or plate

mm/mm per minute was used until the 0.2% yield stress was achieved, at which point the extensometer was removed and the strain rate increased to 0.050 mm/mm per minute. The results of this testing are given in Appendix A, and summarized in the curves of Figures 2-5 to 2-8.

Examination of the test results in Appendix A indicates that the degree of scatter in the elastic modulus values are much larger for the low and elevated temperature tests than for the room temperature tests. Because an accurate value of this parameter was essential for the analysis of the fracture toughness test results, an independent measure of this property was obtained by instrumenting two 2024-T861 specimens with strain gages. Longitudinal and transverse SR-4 gages

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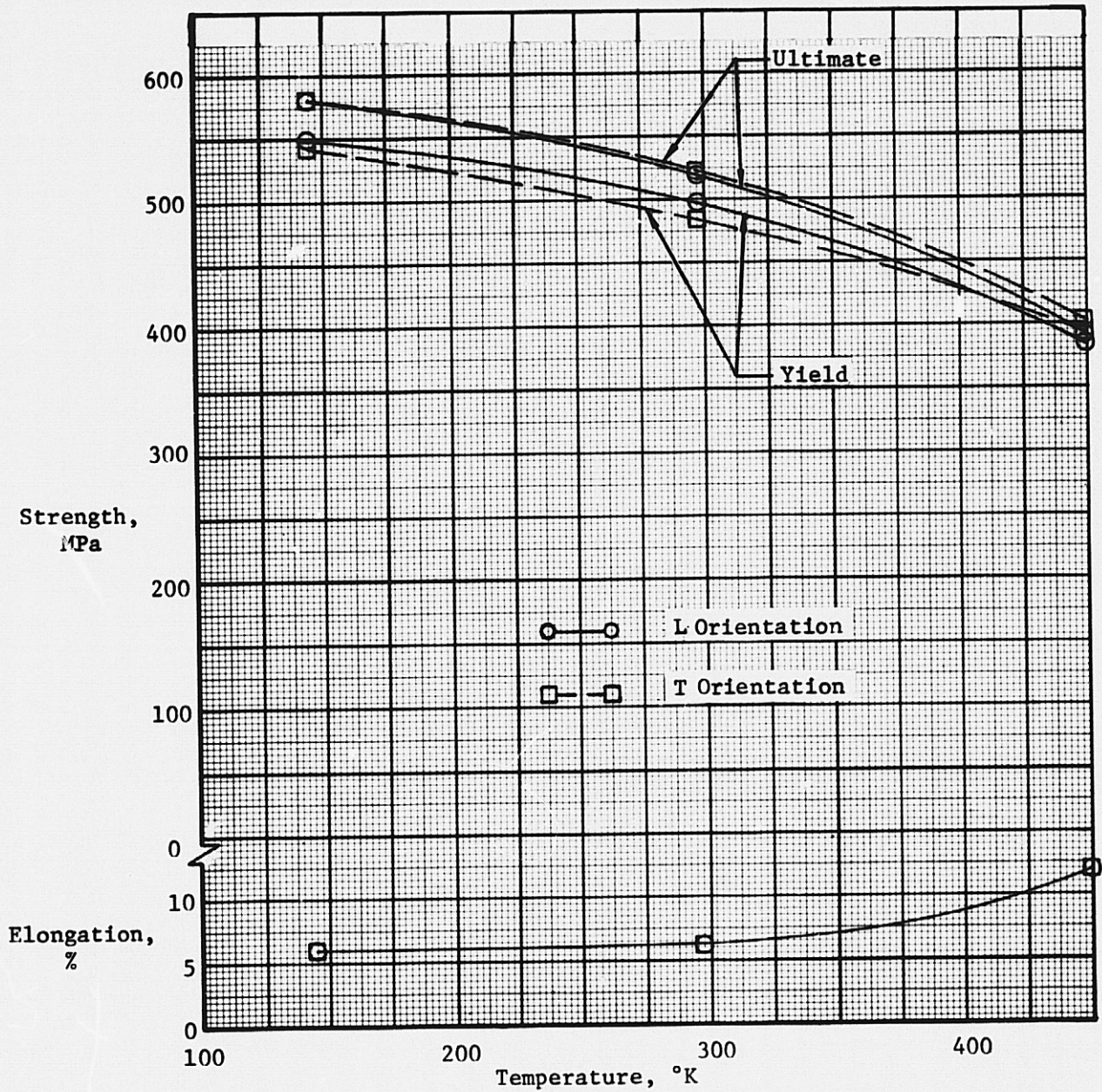


FIGURE 2-5

AVERAGE MECHANICAL PROPERTIES FOR 1.60 MM THICK 2024-T861 SHEET

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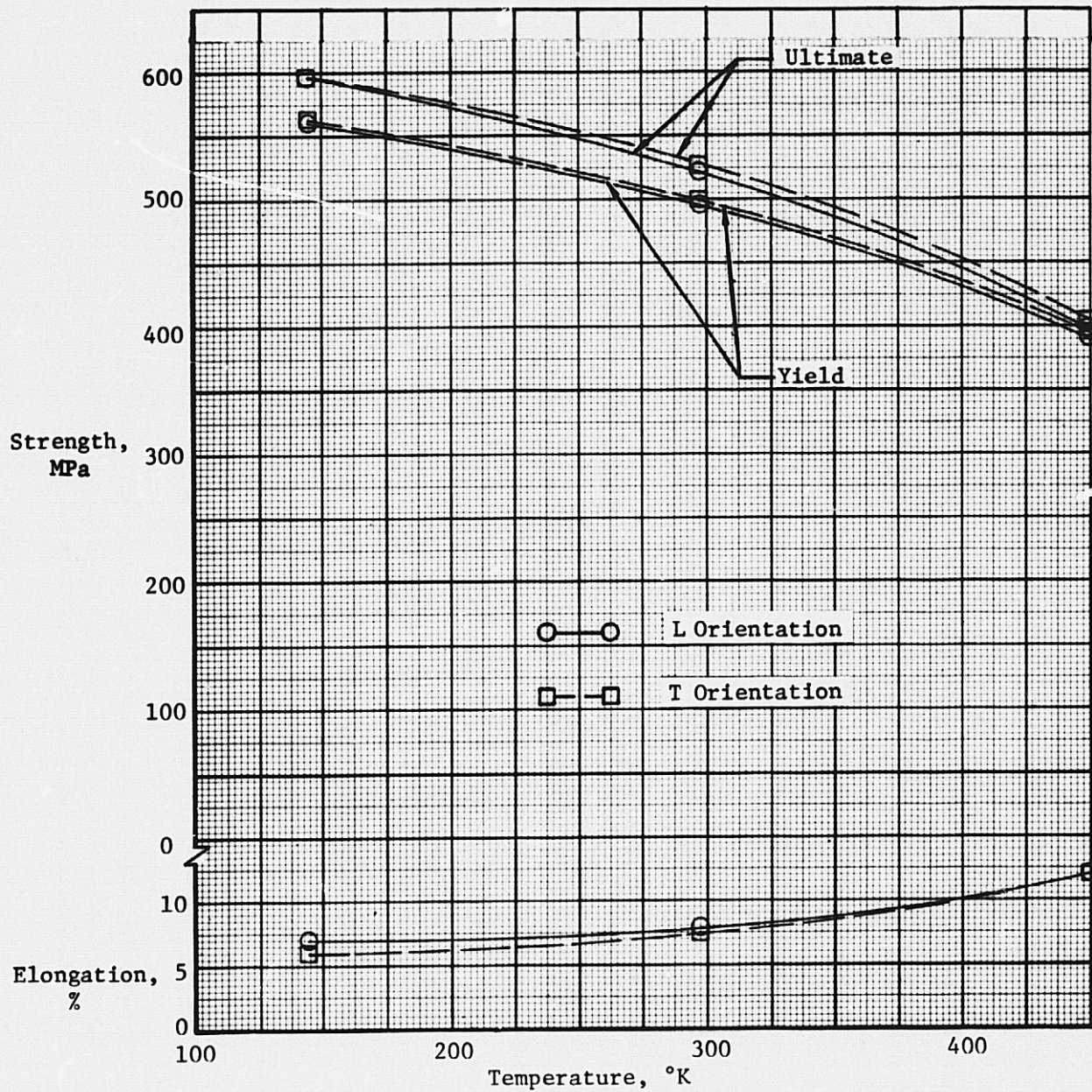


FIGURE 2-6

AVERAGE MECHANICAL PROPERTIES FOR 3.18 MM THICK 2024-T861 SHEET

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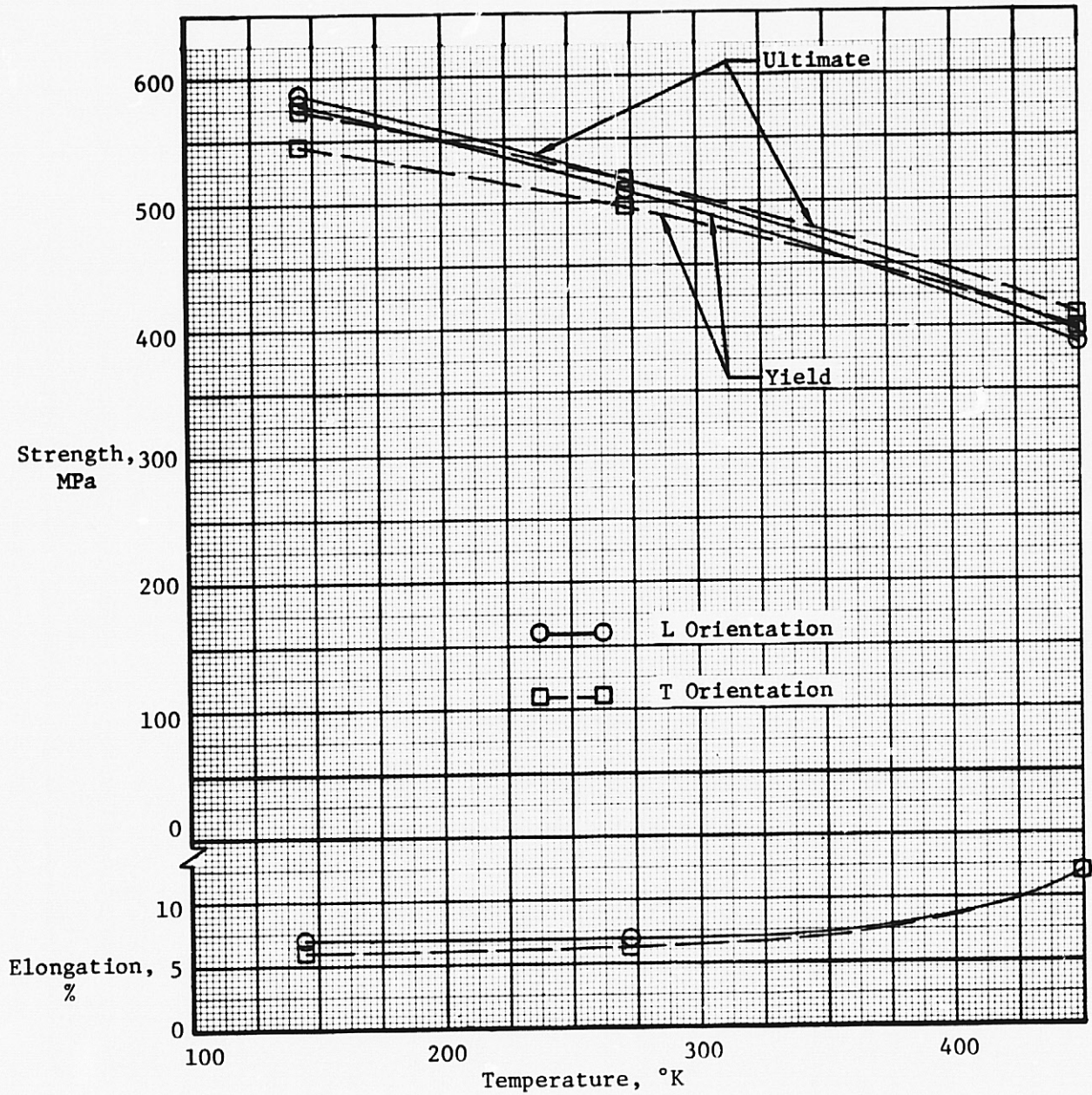


FIGURE 2-7

AVERAGE MECHANICAL PROPERTIES FOR 6.35 MM THICK 2024-T861 SHEET

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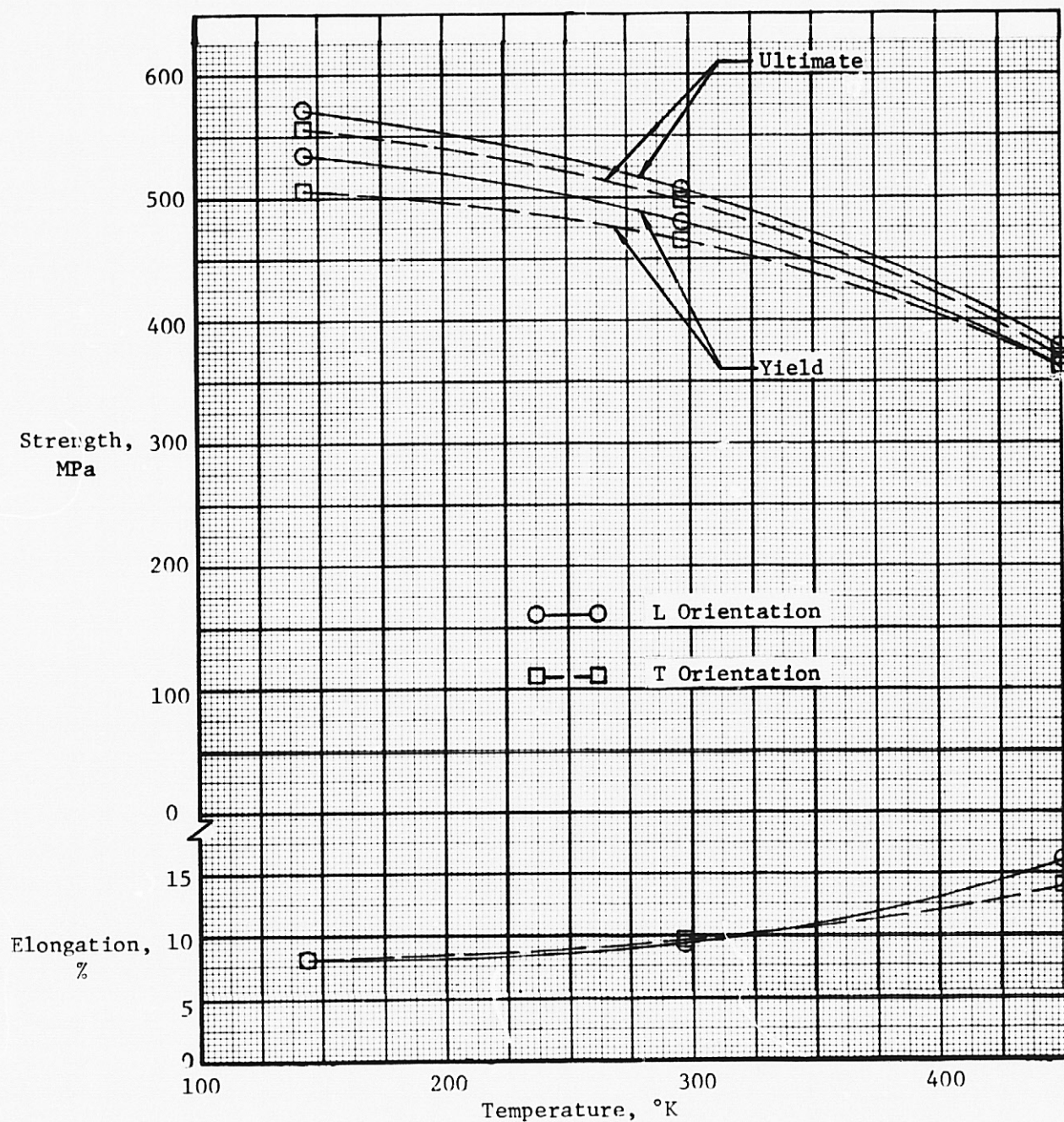


FIGURE 2-8

AVERAGE MECHANICAL PROPERTIES FOR 5.08 CM THICK 2124-T851 PLATE

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Table 2-3

AVERAGE MECHANICAL PROPERTIES OF AS-RECEIVED 2024-T861 ALUMINUM ALLOY SHEET

SHEET THICKNESS mm in	TEST TEMP. °K °F	TEST DIRECTION	F _{ty}		F _{tu}		MODULUS*		ELONGATION, % (5.08cm GAGE LENGTH)
			MPa	ksi	MPa	ksi	10 ³ MPa	10 ⁶ psi	
1.60 .063	144 -200	L	549.3	79.7	581.5	84.3			6.0
	298 + 70	L	497.8	72.2	518.5	75.2			6.3
	450 +350	L	385.0	55.8	391.9	56.8			12.0
1.60 .063	144 -200	T	543.0	78.8	582.6	84.5			6.0
	298 + 70	T	484.4	71.7	522.6	75.8			6.3
	450 +350	T	393.0	57.0	402.2	58.3			12.0
3.18 .125	144 -200	L	560.8	81.3	597.6	86.7	78.53	10.7	7.0
	298 + 70	L	496.4	72.0	522.6	75.8	71.02	10.1	7.8
	450 +350	L	391.3	56.8	397.6	57.7	58.54	9.8	12.0
3.18 .125	144 -200	T	563.1	81.7	596.4	86.5			6.0
	298 + 70	T	498.5	72.3	528.8	76.7			7.5
	450 +350	T	396.5	57.5	403.4	58.5			12.0
6.35 .250	144 -200	L	579.2	84.0	586.1	85.0			7.0
	298 + 70	L	510.2	74.0	517.1	75.0			6.8
	450 +350	L	386.1	56.0	396.5	57.5			12.0
6.35 .250	144 -200	T	546.5	79.3	574.6	83.3			6.0
	298 + 70	T	497.8	72.2	517.1	75.0			6.3
	450 +350	T	397.8	57.7	409.1	59.3			12.0

* MODULUS VALUES OBTAINED FROM STRAIN-GAGED SPECIMENS

were mounted on both sides of the specimens and appropriately wired to eliminate bending effects. Each specimen was elastically loaded and unloaded several times in order to produce sets of load/strain data at 144, 294 and 450°K (-200, 70, 350°F). A least squares regression analysis was performed on each data set to yield an average value of elastic modulus. These average modulus values and the average values for the other mechanical properties listed in Appendix A are summarized in Tables 2-3 and 2-4.

Besides measuring the mechanical properties, the as-received materials were further characterized using spectrographic and metallographic techniques. A set of coupons representing each alloy/thickness combination was chemically analyzed using the spectrographic procedures set forth in ASTM-E-101-67. The results of

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Table 2-4

AVERAGE MECHANICAL PROPERTIES OF AS-RECEIVED 2124-T851 ALUMINUM ALLOY PLATE

TEST TEMPERATURE °K °F	SPECIMEN ORIENTATION	F _{ty}		F _{tu}		ELONGATION, % (5.08 cm GAGE LENGTH)
		MPa	ksi	MPa	ksi	
144 -200	L	534.4	77.5	571.1	82.8	8.0
294 + 70	L	479.2	69.5	506.8	73.5	9.3
450 +350	L	362.0	52.5	377.2	54.7	16.0
144 -200	T	506.8	73.5	556.2	80.7	8.0
294 + 70	T	465.4	67.5	497.8	72.2	9.5
450 +350	T	362.0	52.5	368.9	53.5	14.0

this analysis are presented in Table 2-5, together with the chemistry requirements of the applicable specifications. Examination of this table indicates that the chemistry of the alloys used in this program were within specifications.

A second set of coupons was examined metallographically; the results are shown in Figures 2-9 through 2-12. These photomicrographs all show the elongated grains that are typical of wrought products. The structures consist of an aged aluminum solid solution matrix with insoluble particles of Al-Cu-Fe-Mn inter-metallic compounds. Comparison of the three photomicrographs of the 2024-T861 alloy (Figures 2-9, 2-10 and 2-11) shows that sheet thickness has little effect on microstructure. However, the structure of the 2124-T851 plate (Figure 2-11) shows that the volume fraction, average size, and distribution of the particles of intermetallic compounds have significantly decreased. This decrease can be

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Table 2-5

ANALYSIS OF AS-RECEIVED MATERIAL

ELEMENT	2024-T861				2124-T851	
	QQA-250/4 SPECIFICATION	AS-RECEIVED THICKNESS			QQ-A-250/29 SPECIFICATION	AS-RECEIVED 50.8 mm (2.0 INCH) THICK
		1.60 mm (.063 INCH)	3.18 mm (.125 INCH)	6.35 mm (.250 INCH)		
Cu	3.8 - 4.9	4.67	4.40	4.70	3.8 - 4.9	4.43
Mg	1.2 - 1.8	1.31	1.25	1.36	1.2 - 1.8	1.21
Mn	0.3 - 0.9	0.53	0.58	0.63	0.3 - 0.9	0.48
Fe	0 - 0.5	0.23	0.24	0.24	0 - 0.3	0.12
Zn	0 - 0.25	0.20	0.13	0.12	0 - 0.25	<0.03
Si	0 - 0.50	0.20	0.19	0.19	0 - 0.20	0.15
Ti	-	0.032	0.036	0.035	0 - 0.15	0.023
Cr	0 - 0.10	0.016	0.016	<.01	0 - 0.10	<.002

attributed to the cleaner chemistry of the 2124 alloy, as indicated in Table 2-5. The slightly lower strength and higher ductility of the 2124 alloy is related to its cleaner chemistry, as well as the thermo-mechanical processing differences between the T851 and the T861 conditions.

2.4 REFERENCES

- 2-1. Alcoa Aluminum Handbook, Aluminum Company of America, 1967.

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MAGNIFICATION: 100X

Thickness

Rolling Direction

MAGNIFICATION: 500X

Thickness

ETCHANT: 7 grams $(\text{NH}_4)_2 \text{S}_2\text{O}_8$, 1 ml HF, 99 ml H_2O

FIGURE 2-9

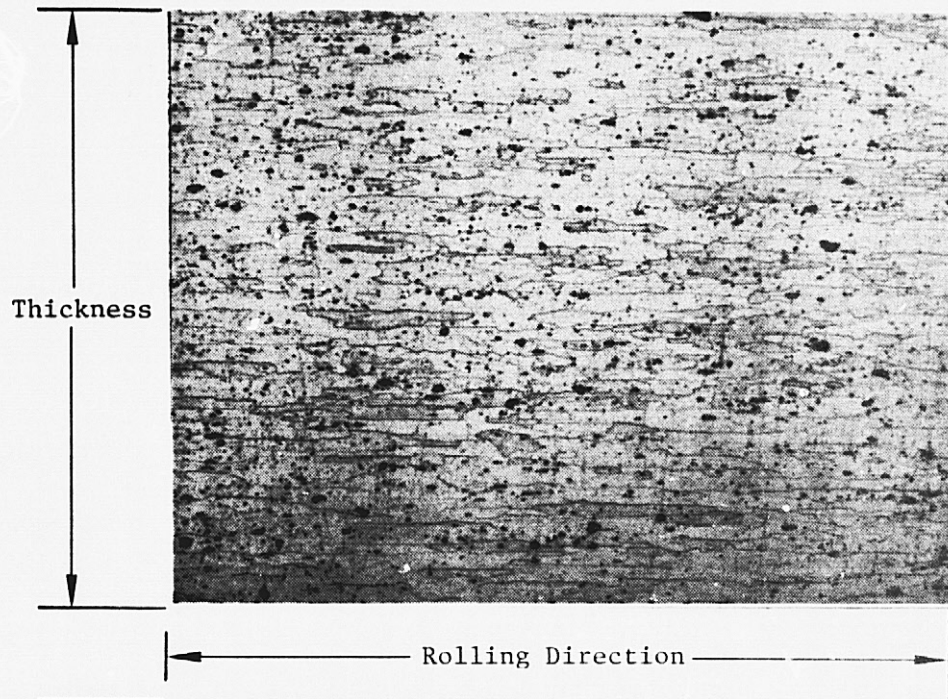
MICROSTRUCTURE OF AS-RECEIVED 1.60 MM THICK 2024-T861 SHEET

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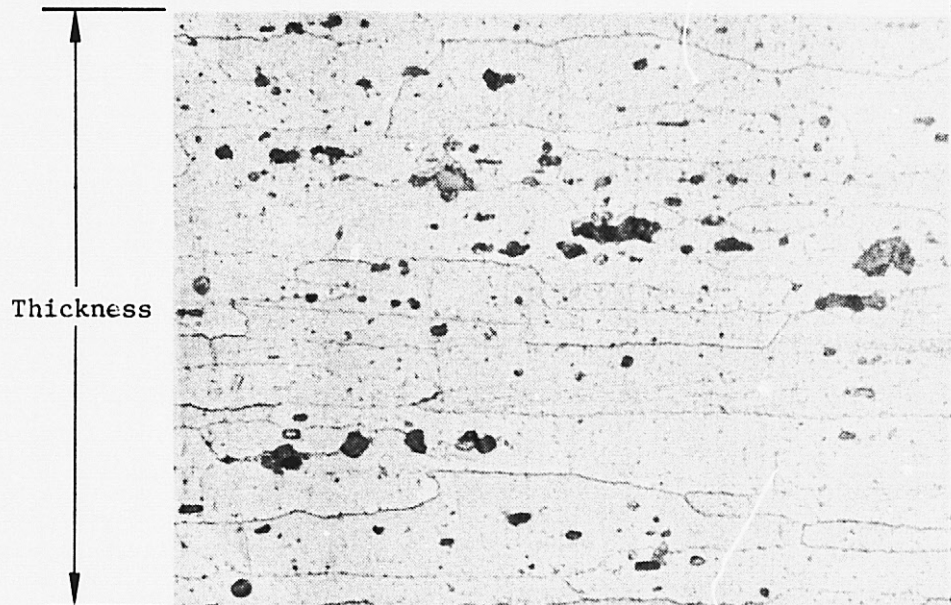
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MAGNIFICATION: 100X



MAGNIFICATION: 500X



ETCHANT: 7 grams $(\text{NH}_4)_2\text{S}_2\text{O}_8$, 1 ml HF, 99 ml H_2O

FIGURE 2-10

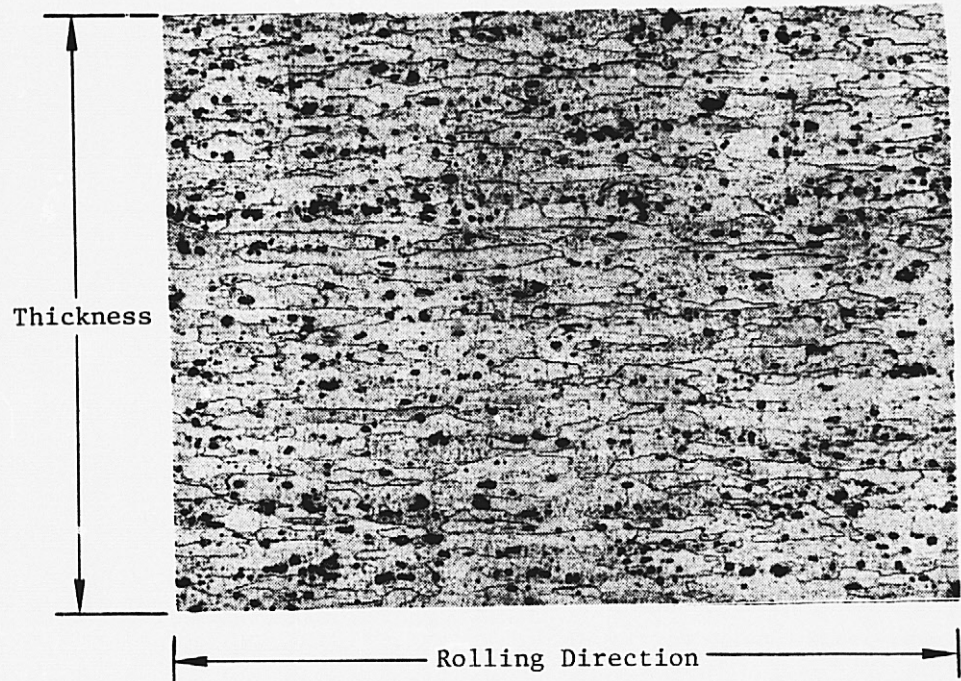
MICROSTRUCTURE OF AS-RECEIVED 3.18 MM THICK 2024-T861 SHEET

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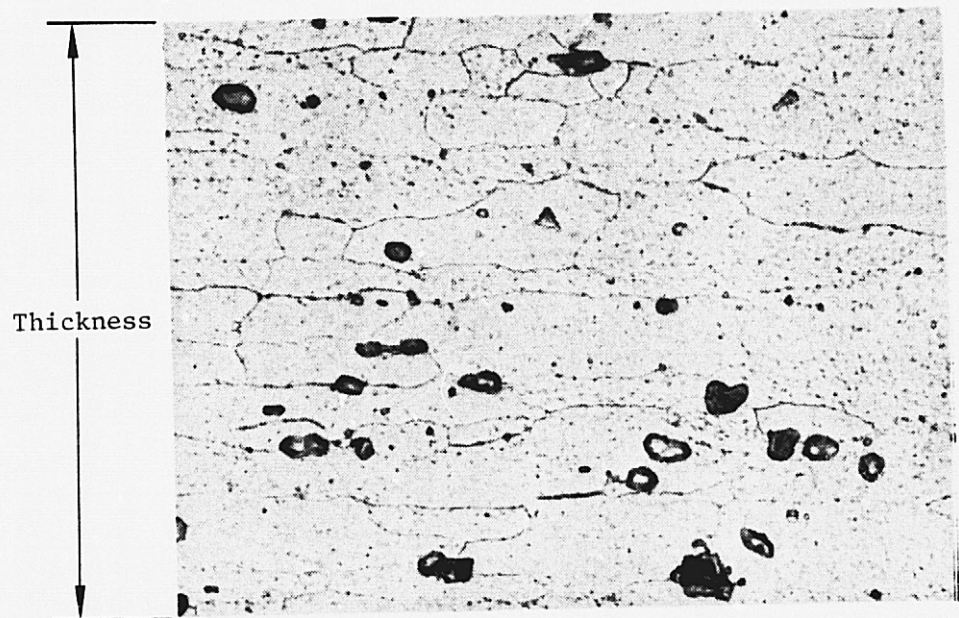
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MAGNIFICATION: 100X



MAGNIFICATION: 500X



ETCHANT: 7 grams $(\text{NH}_4)_2\text{S}_2\text{O}_8$, 1 ml HF, 99 ml H_2O

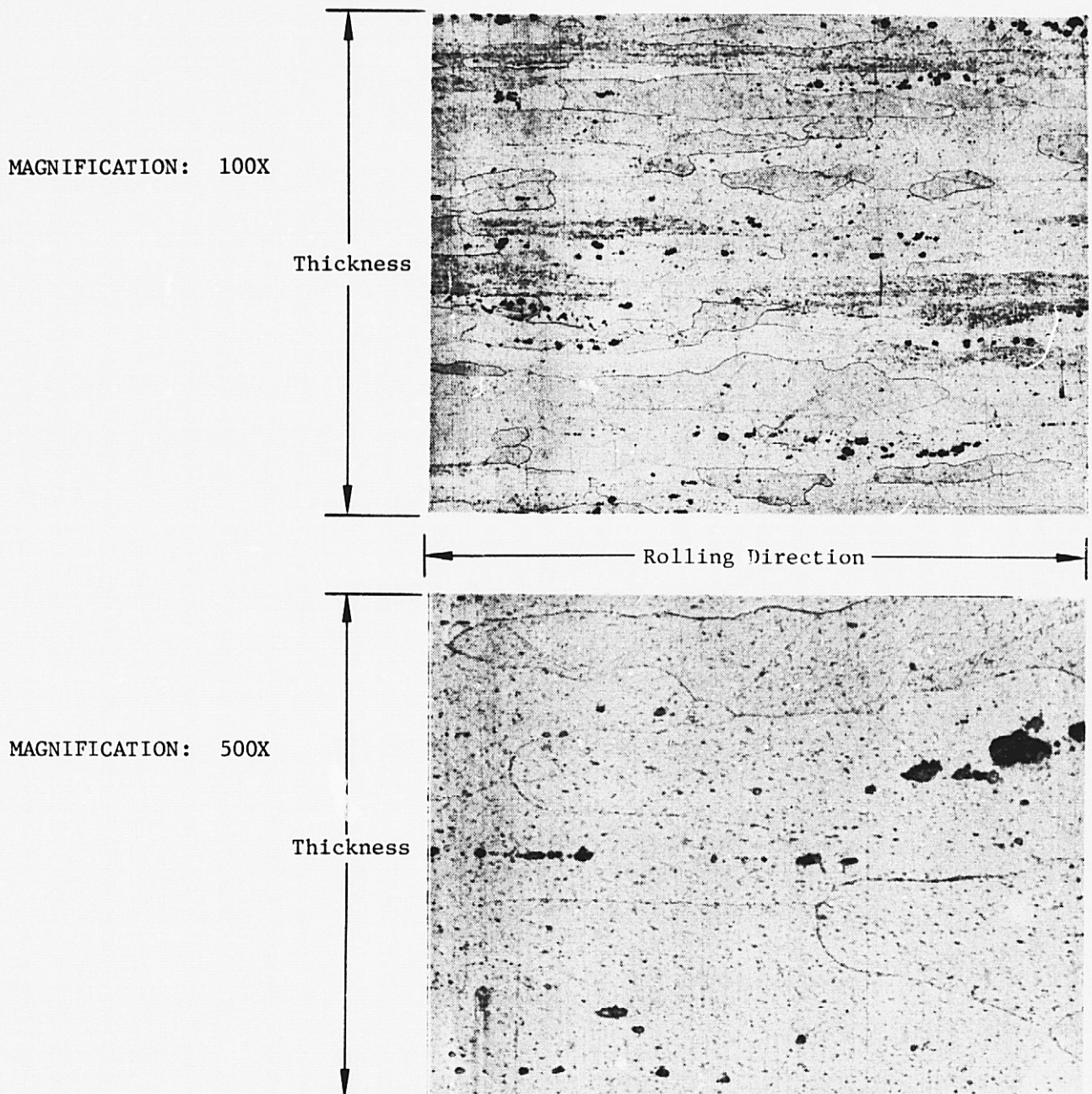
FIGURE 2-11

MICROSTRUCTURE OF AS-RECEIVED 6.35 MM THICK 2024-T861 SHEET

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ETCHANT: 7 grams $(\text{NH}_4)_2 \text{S}_2\text{O}_8$, 1 ml HF, 99 ml H_2O

FIGURE 2-12

MICROSTRUCTURE OF AS-RECEIVED 5.08 CM THICK 2124-T851 PLATE

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Section 3 FRACTURE TOUGHNESS TESTING

The specimen thicknesses selected for testing under this program were not thick enough to produce plane strain conditions over all expected stress ranges. As a result, stable flaw growth with significant plastic deformation at the crack tip was expected to occur prior to the onset of crack instability. Under plane strain conditions, little or no stable flaw growth occurs prior to instability because of the severe constraint imposed by the triaxial stress state at the crack tip; ASTM E-399-74 (Reference 3-1) defines the critical stress intensity, K_{IC} , as the load at which two per cent crack extension occurs. Under such constraint, the size of the crack-tip plastic region is small compared with the crack size and the specimen dimensions. Because conditions of plane stress were expected to occur for all tests, the stress intensity at crack instability could not be defined using the procedure specified in Reference 3-1. The most informative method available for presenting plane stress fracture data is the crack growth resistance curve. These R-curves, plotted as stress intensity vs. crack extension, yield quantitative information as to the amount of slow stable crack growth that precedes fracture for a given material. Moreover, they can be used to define the plane stress critical stress intensity, K_c , for any structural configuration for which the interrelationship of stress intensity, applied load, and flaw size is known.

3.1 COMPLIANCE CALIBRATION

In order to produce crack growth resistance curves, the crack length must be monitored throughout each test. The primary method used in this program to obtain

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this information is similar to that described in Reference 3-1, in which a double beam displacement gage monitors the relative displacement of two positions spanning the crack. For the fracture toughness tests conducted under this program, the double beam displacement gage described in Reference 3-1 was inserted between two knife edges attached to the specimen as shown in Figure 3-1. These knife edges were fabricated with probes on one side that had semicircular tips that fit the 3.18 mm (0.125 inch) diameter hole drilled at the center of the specimen.

Prior to the initiation of fracture toughness testing, the relationship between crack opening displacement, applied load and crack length had to be established for the particular specimen geometry and displacement gage position adopted for the testing. This relationship was established by conducting a series of elastic calibration tests for various combinations of crack opening displacement, applied load and crack length. The effect of specimen thickness and temperature was also investigated.

These calibration tests were performed in a manner similar to that described in Reference 3-2, in which measurements were made of the specimen compliance (i.e., the amount of displacement per unit of applied load) at successively longer crack lengths. For these calibration tests, narrow sawcuts were used to simulate fatigue cracks; crack lengths varied from 1.27 cm (0.500 inch) to 20.3 cm (8.0 inches). At each crack length, the specimen was incrementally loaded to some maximum static load which was calculated to produce a predetermined value of stress intensity, K_{max} . At each load level, the crack-opening-displacement (COD) of the 3.18 mm (0.125 inch) diameter hole at the center of the sawcut was measured with the displacement gage. The specimen compliance, (COD)/P, at each crack length was calculated by performing a least squares analysis on the data pairs.

Initial calibration tests were conducted using two 6.35 mm (0.250 inch) and one 1.60 mm (0.063 inch) thick 2024-T861 specimens and a maximum stress intensity

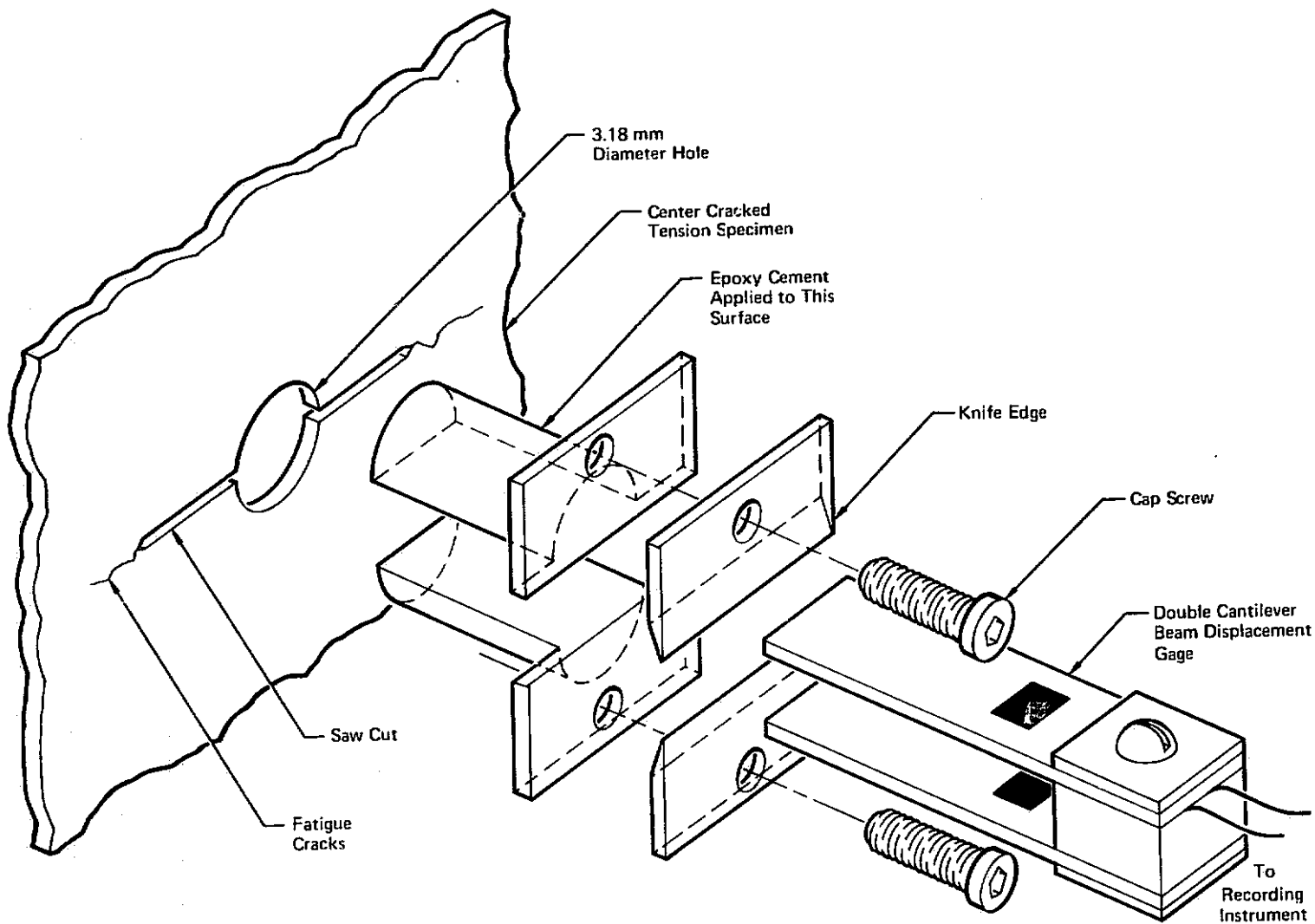


FIGURE 3-1

INSTRUMENTATION TECHNIQUE FOR OBTAINING CRACK OPENING DISPLACEMENT (COD) MEASUREMENTS

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of 13.1 MPa $\sqrt{\text{m}}$ (12 ksi $\sqrt{\text{in.}}$), a value approximately half the K_{IC} value (References 3-3 to 3-6). In order to maintain this value as crack size increased, the maximum static load was decreased. The following equation was used to relate stress intensity, full section stress and crack length:

$$K = \sigma \sqrt{\pi a} Z \quad (3-1)$$

where σ = full section stress

a = half crack length

Z = finite width correction factor

= $\sec (\pi a/w)$

The compliance/crack length data obtained from these three specimens were normalized to account for differences in thickness and specimen width. Inspection of this normalized data indicated an unacceptably high degree of scatter. Analysis of the experimental technique showed that the scatter could be attributed to the condition of the test specimens and the loads used in calibration. Inspection of several as-machined specimens of 2024-T861 sheet of various thicknesses showed the flatness to be within 0.2 per cent, measured over a 75.57 cm (29.75 inch) contact length. Although this curvature is well within AMS specifications for aluminum sheet (i.e., AMS 2202J), inconsistent compliance readings were obtained because the uniaxial tensile loads used during this initial phase of compliance testing were not great enough to fully eliminate the curvature. This sensitivity of specimen compliance to applied load is well portrayed in the load/deflection data of Figure 3-2. This data was obtained on a 6.34 mm (0.250 inch) thick 2024-T851 specimen that contained a 20.3 cm (8.0 inch) long sawcut. For loads up to 44,500 N (10 kips), the specimen compliance ($\Delta\text{COD}/\Delta P$) is 4.344 mm/MN (0.7586×10^{-6} in./lb.); for loads up to 80,100 N (18 kips), this value increases approximately four percent to 4.513 mm/MN (0.7×10^{-6} in./lb.). This higher load corresponds to a stress

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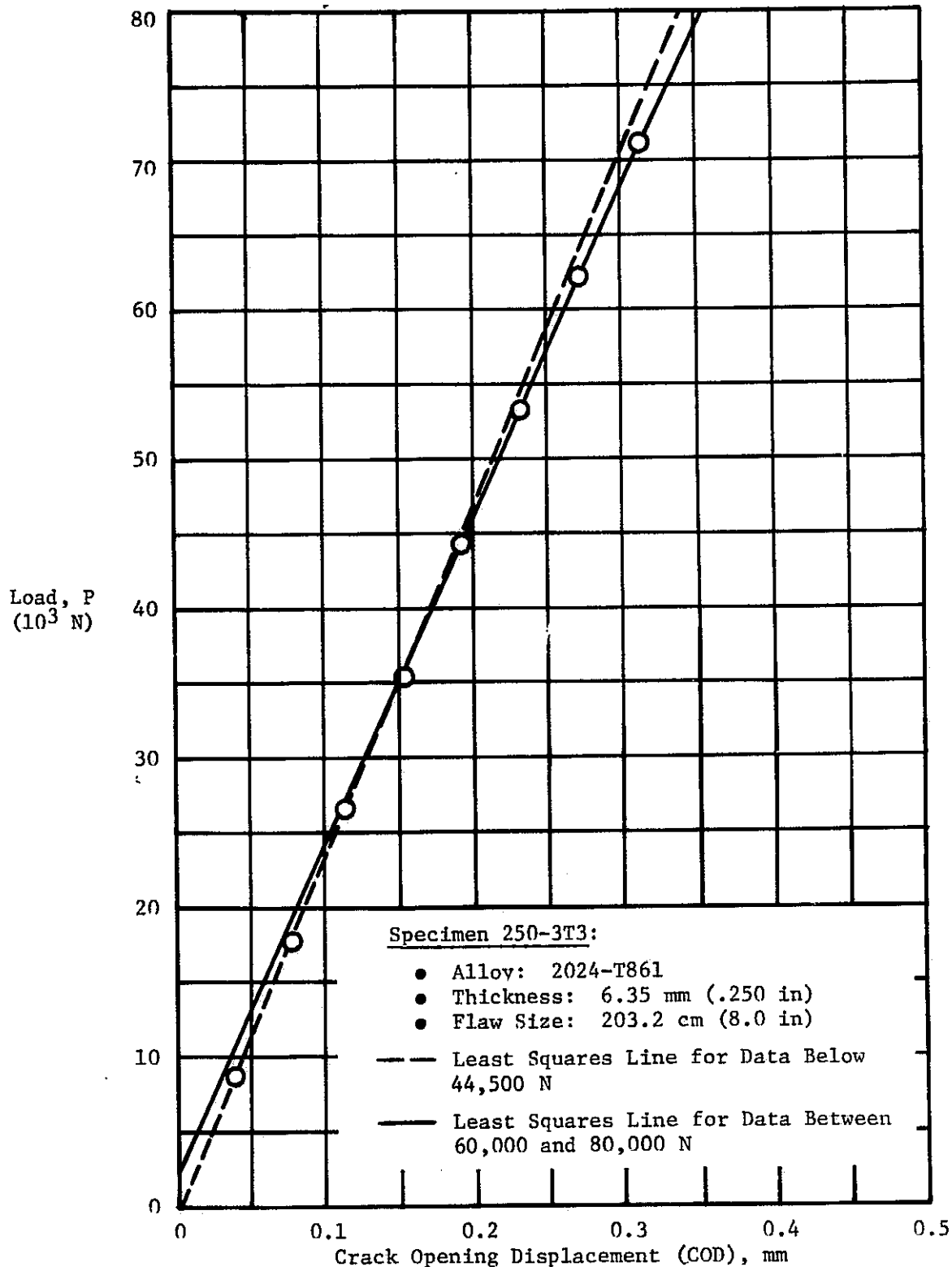


FIGURE 3-2

LOAD/CRACK OPENING DISPLACEMENT DATA FOR SPECIMEN 250-3T3

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intensity of approximately $22.0 \text{ MPa } \sqrt{\text{m}}$ ($20 \text{ ksi } \sqrt{\text{in.}}$), or approximately 80 percent of the average K_{IC} value used previously.

In order to produce more consistent compliance calibration curves, four additional specimens were calibrated using a maximum stress intensity of $22.0 \text{ MPa } \sqrt{\text{m}}$ ($20 \text{ ksi } \sqrt{\text{in.}}$). The specimens used for these tests were a 2124-T851 specimen with a thickness of 11.4 mm (0.450 inch) and three 2024-T861 specimens with thicknesses of 1.60, 3.18 and 6.35 mm (0.063, 0.125 and 0.250 inch). The 6.35 mm (0.250 inch) thick 2024-T861 specimen was calibrated at 144, 294 and 450°K (-200, 70 and 350°F) by cooling or heating the specimen to the desired temperature for each crack length investigated. The low and elevated temperatures were obtained using the procedures described in Section 3.2.2. Because buckling effects were expected to influence the compliance readings, the two thinnest gage 2024-T861 specimens were calibrated both with and without Teflon-coated stiffener plates clamped across the specimen width above and below the crack. For the 3.18 mm (0.125 inch) thick specimen, compliance data was obtained over the same range of crack lengths for both the stiffened and unstiffened conditions. However, for the 1.60 mm (0.063 inch) thick specimen, compliance data in the unstiffened condition could only be obtained for crack lengths less than half of the specimen width. Crack lengths larger than this value caused such large out-of-plane deflections that the compliance gage could no longer be supported on the knife edges attached to the specimen. When stiffener plates were used, compliance data was obtained over the full range of crack lengths investigated.

For the compliance tests performed at higher stress intensities, load/COD data was obtained for K values between 0 and $22 \text{ MPa } \sqrt{\text{m}}$ ($0\text{--}20 \text{ ksi } \sqrt{\text{in.}}$); however, only data in the range $13.1\text{--}22 \text{ MPa } \sqrt{\text{m}}$ ($12\text{--}20 \text{ ksi } \sqrt{\text{in.}}$) was used to compute compliance values; such procedures avoided undesirable bending effects introduced by specimen curvature at the lower loads. The elastic compliance data obtained from these

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calibration tests, including the actual load/displacement data, is reported in Appendix B.

The elastic compliance data shown in Appendix B was compared to a mathematical model of the center cracked tension specimen. Since crack-opening-displacement (COD) measurements were made at either end of a 3.18 mm (0.125 inch) diameter hole drilled at the center of the crack in each specimen, the experimentally measured compliance values could be compared directly with those predicted by the equation presented below, as taken from Reference 3-7. The vertical deflection (V_o) along the positive y-axis in Figure 3-3 under an elastic load can be described by the equation:

$$V_o = \frac{2a \sigma}{E} \quad (3-2)$$

where a = half crack length

σ = applied stress

$= P/(tw)$

P = applied load

t = specimen thickness

w = specimen width

E = modulus

Because of symmetry, the COD measured across a 3.18 mm (0.125 inch) diameter hole is

$$(COD) = 2 V_o = \frac{4a \sigma}{E} \quad (3-3)$$

Since compliance is defined as the amount of deflection per unit applied load, the elastic compliance of the specimen across the hole is

$$C = \frac{2 V_o}{P} = \frac{4a}{twE} \quad (3-4)$$

Equation (3-4) predicts the elastic compliance of a center cracked tensile specimen having a flaw length that is small compared to the specimen width. For larger flaws, finite width effects can be accounted for by employing a finite width correction factor;

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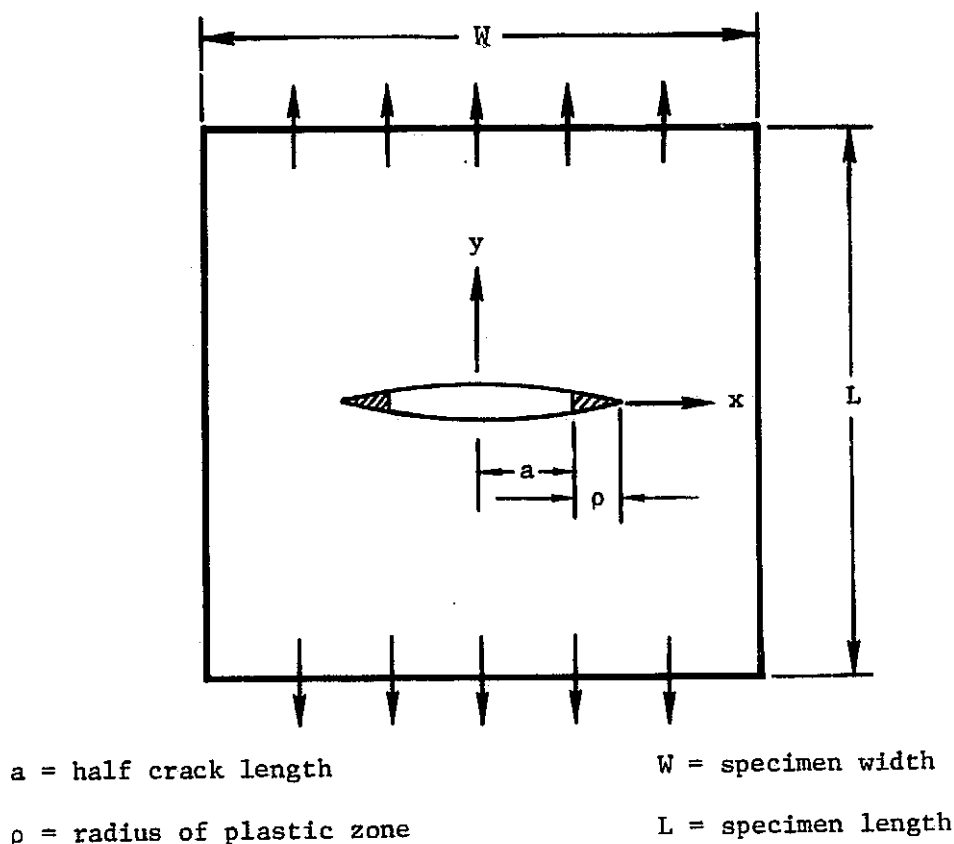


FIGURE 3-3

DUGDALE MODEL OF A CENTER-CRACKED TENSION SPECIMEN

the secant function described in Reference 3-8 has been shown to accurately account for such effects. Incorporating this term, equation (3-4) can be rewritten as:

$$C = \frac{4a}{twE} \cdot Z \quad (3-5)$$

where Z = finite width correction factor
 $= \sec (\pi a/w)$

Equation (3-5) was used to predict the compliance data of Appendix B for each flaw size/temperature/thickness combination investigated. The results of this

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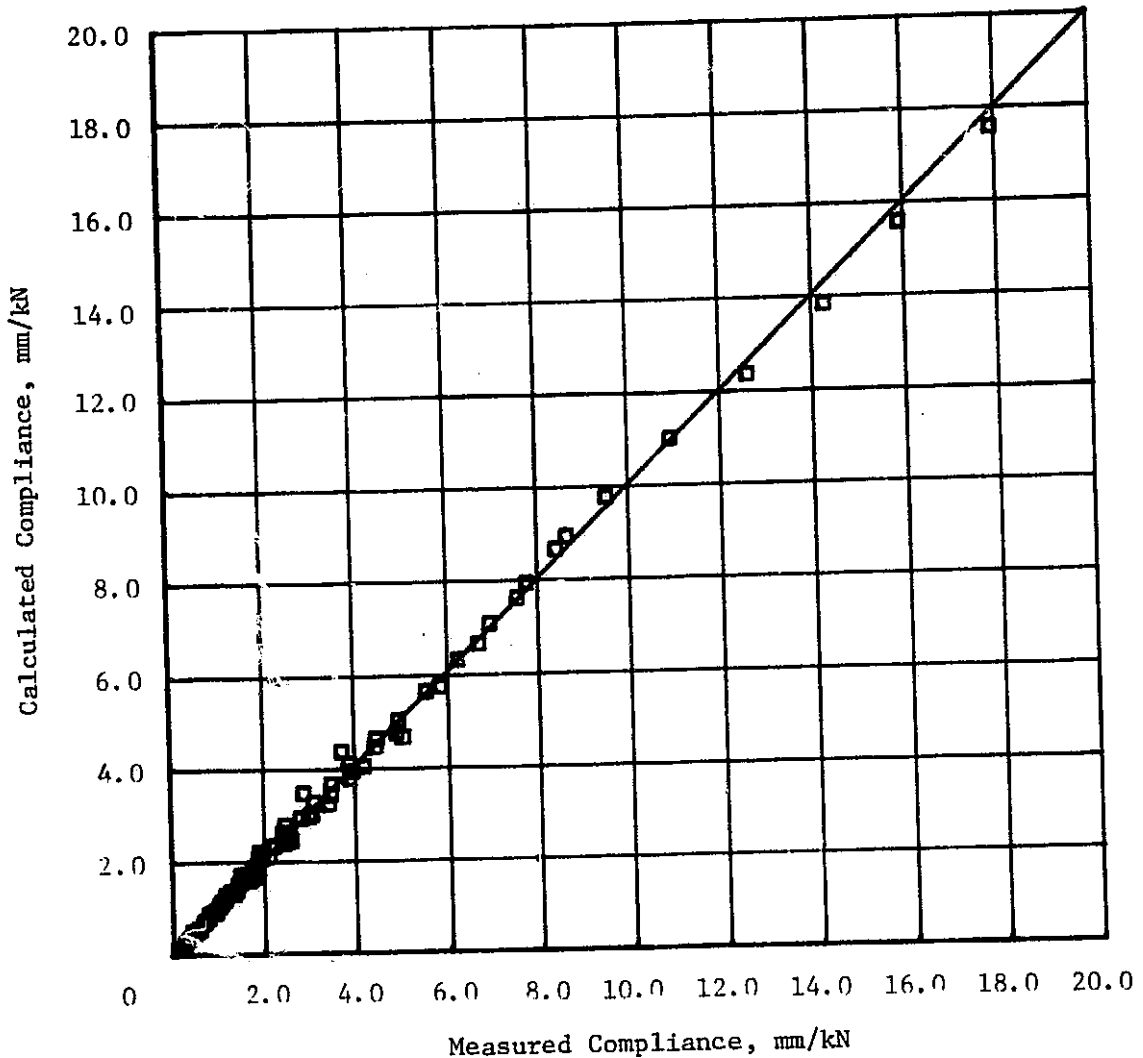


FIGURE 3-4

CALCULATED VS MEASURED COMPLIANCE VALUES FOR STIFFENED THIN GAGE SPECIMENS
(Equation 3-5 used to obtain calculated values)

analysis, shown in Figure 3-4, indicate excellent agreement between calculated and measured compliance values for all data where buckling effects were suppressed. A regression analysis was performed on the compliance data of Appendix B using equation (3-5); a correlation coefficient of 0.993 and a standard error of estimate of 0.072 was obtained.

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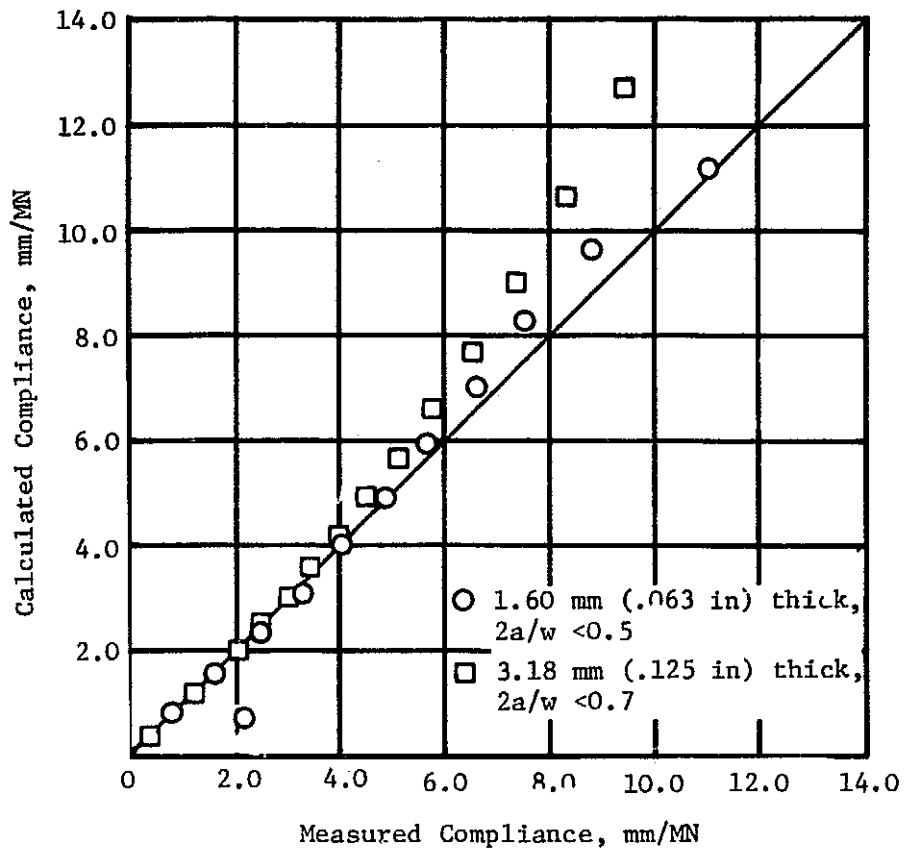


FIGURE 3-5

CALCULATED VS MEASURED COMPLIANCE VALUES FOR UNSTIFFENED THIN GAGE SPECIMENS

Attempts were made to use equation (3-5) to predict the compliance of specimens when buckling was allowed to occur. The results, shown in Figure 3-5, indicate that, at the higher values, the elastic compliance calculated using equation (3-5) does not agree well with that measured from the slope of the appropriate load/COD data in Appendix B. Such results are expected, since out-of-plane deflections essentially reduce the vertical in-plane displacement component at the edges of the crack. It is known (Reference 3-9) that such out-of-plane deflections increase with both crack size and applied load. As a result, larger

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than actual flaw sizes would be predicted using equation (3-5). Since no mathematical model has yet been developed to accurately relate flaw size to crack opening displacement when buckling occurs, it was concluded that the displacement gage technique is not applicable to unstiffened toughness tests.

Although equation (3-5) can be used to interpret the load/COD data obtained from the toughness tests where buckling does not occur, its use would introduce some error into the prediction of crack length, since it is valid only for elastic loading conditions. At high loads, significant plastic deformation is likely to occur ahead of the crack tip, thus making some contribution to the crack opening displacement measurement. If such contributions are ignored, a larger crack length than actually exists will be predicted by equation (3-5), and any fracture toughness parameter based on this flaw size will be unrealistically high. Since the data generated under this program is to be used for fracture control analyses, such predictions might result in inaccurate predictions of component life as well as optimistic standards for nondestructive inspection. As a result, another relationship was investigated that takes into account the size of the plastic zone ahead of the crack tip. This equation, developed by Forman (Reference 3-10), is based on the Dugdale model (Figure 3-3) for a crack in tension under plane stress with a yield zone at the crack tip. The vertical deflection along the positive y-axis for this case is predicted to be:

$$V_o = \frac{\sigma a}{E (2\beta)} \ln \left[\frac{\sin \beta + 1}{\sin \beta - 1} \right]^2 \quad (3-6)$$

$$\text{where } \beta = \frac{\pi}{2} \frac{\sigma}{F_{TY}}$$

F_{TY} = yield strength

This equation can be simplified to:

$$V_o = \frac{a F_{TY}}{\pi E} \ln \left[\frac{\sin \beta + 1}{\sin \beta - 1} \right]^2 \quad (3-7)$$

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The compliance can then be expressed as:

$$C = \frac{2 V_o}{P} = \frac{2a F_{TY}}{\pi EP} \ln \left[\frac{\sin \beta + 1}{\sin \beta - 1} \right]^2 \quad (3-8)$$

The use of equation (3-8) is strictly limited to materials which undergo no strain hardening. However, the use of this equation was considered appropriate because the strain hardening exhibited by the alloys evaluated was small; i.e., the ratio of yield to ultimate strength varied from .91 to .98.

To determine the accuracy of equation (3-8), several fracture toughness specimens were loaded, unloaded and reloaded prior to failure in an attempt to separate plasticity effects from actual crack extension. Initial attempts at applying equation (3-8) to these load/COD curves resulted in crack length predictions which significantly underestimated the actual values at the point of unloading. A procedure similar to that outlined in Reference 3-11 was used in which equation (3-5) is first used to compute the initial flaw size from the elastic portion of the load/COD curve. These values and the actual values obtained from measurements of the fracture surface are compared and any differences added or subtracted from subsequent determinations of flaw size made using the load/COD curve and equation (3-8). Frequently, this adjustment was of the same order of magnitude as the amount of actual flaw extension.

Analysis of this procedure indicated that the conservative results obtained using this procedure were primarily caused by a difficulty in determining the actual origin of each load/COD curve. Due to such effects as crack closure forces, slack in the loading train, and specimen warpage, the first few thousand pounds of applied load usually produced a load/COD curve which was nonlinear, even though the applied load was fully elastic. This nonlinearity near the origin makes it extremely difficult to make accurate crack length predictions using equation (3-8). This equation is especially sensitive to the position of the origin of the load/COD

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curve, since actual load/COD coordinates are required for computation of flaw size. Such is not the case for equation (3-6), which requires only that the slope of the load/COD curve be established.

To circumvent these problems, a procedure was developed that involved using equation (3-5) to plot an "ideal" load/COD curve for each specimen based on the initial flaw size measurement obtained from the fracture surface. This curve was plotted on transparent paper using the same scale factors as the experimental load/COD curve; it was then superimposed on the experimental curve and adjusted until a tangency condition was obtained. The intersection of the "ideal" curve with the COD axis at zero load was then defined as the true origin for the experimental curve.

Using this procedure, crack length predictions based on equation (3-8) were made for the specimens which had been loaded and reloaded. The results, shown in Table 3-1 and plotted in Figure 3-6, indicate that more accurate crack length predictions can be made when plasticity effects are taken into account (i.e., by equation (3-8)) than if such effects are ignored, as in equation (3-5). These results are significant since all specimens analyzed were stressed to loads of more than 80 per cent of the subsequent failure load prior to unloading.

3.2 TEST PROCEDURE

A total of 126 fracture toughness tests were conducted during this phase of the program. A detailed test matrix for each alloy is presented in Table 3-2.

3.2.1 Specimen Preparation

As shown in Table 3-2, three specimens were tested for each alloy/thickness/temperature/orientation combination. A different initial flaw size was introduced into each one of these three specimens in order to cause the largest possible spread in full section failure stresses. In order to more easily ascertain the

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Table 3-1

RESULTS OF CRACK EXTENSION PREDICTIONS

SPECIMEN	THICKNESS mm in	INITIAL FLAW SIZE, a_0 mm in	CRACK LENGTH AT UNLOADING			CRACK EXTENSION, Δa		
			ACTUAL ¹ mm in	DUGDALE ² mm in	ELASTIC ³ mm in	ACTUAL ¹ mm in	DUGDALE ² mm in	ELASTIC ³ mm in
63-2L3	1.64 .0647	12.68 0.499	15.16 0.597	14.35 .565	15.67 .617	2.49 .098	1.68 .066	3.00 .118
63-6T5	1.64 .0647	31.83 1.253	35.56 1.400	35.92 1.414	39.80 1.567	3.76 .148	4.11 .162	7.98 .314
125-6T1	3.26 .1282	12.95 0.510	13.74 0.541	12.95 0.510	13.21 0.520	0.79 .031	0.00 .000	0.28 .011
125-2L11	3.23 .1273	32.64 1.285	35.36 1.392	35.92 1.414	40.87 1.609	2.72 .107	3.28 .129	8.23 .324
125-3T9	3.21 .1265	35.05 1.380	41.53 1.635	42.93 1.690	47.19 1.858	6.50 .256	7.87 .310	12.17 .479
125-3T4	3.26 .1282	48.18 1.897	51.87 2.042	51.54 2.029	54.13 2.131	3.68 .145	3.38 .133	5.94 .234
1L2-256-3	6.40 .2520	28.09 1.106	15.88 0.625	15.54 0.612	17.30 0.681	1.83 .072	1.50 .059	3.25 .128
3T8-259-3	6.36 .2503	6.15 0.242	15.80 0.622	13.77 0.542	16.66 0.656	9.65 .380	7.65 .301	10.52 .414
5L1-453-1	11.43 .4500	44.17 1.739	48.54 1.911	46.81 1.843	48.29 1.901	4.39 .173	2.64 .104	4.14 .163

1. Determined from the slope of the unloading curve
2. Determined using the Dugdale model (Equation 3-8) and coordinates at point of unloading.
3. Determined using the elastic model (Equation 3-5) and coordinates at point of unloading.

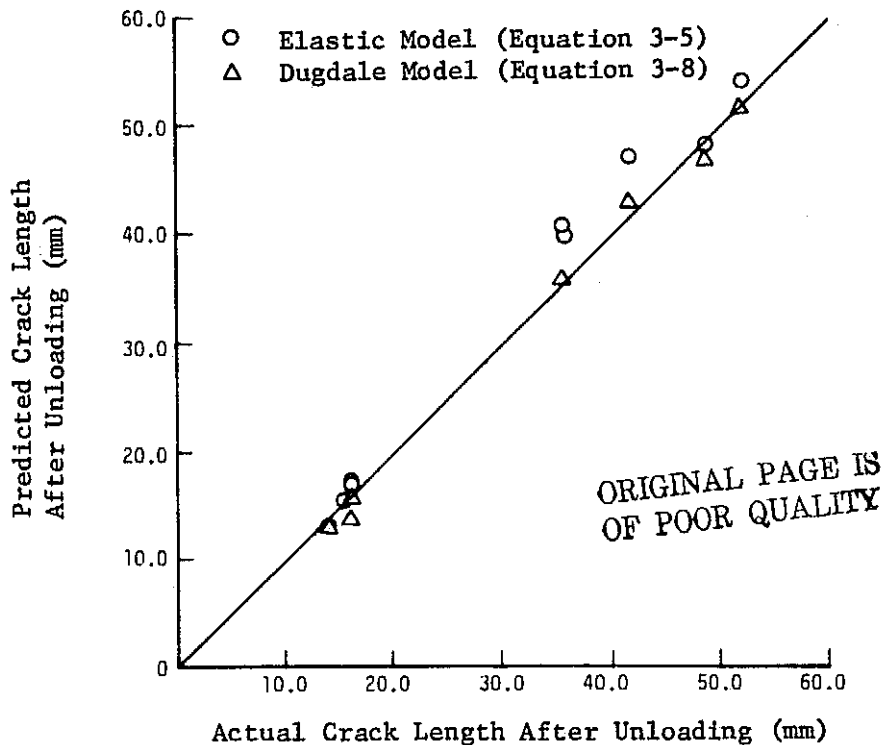


FIGURE 3-6

PREDICTED VS ACTUAL CRACK LENGTH FOR SPECIMENS LOADED AND RELOADED

Table 3-2

TEST MATRIX FOR FRACTURE TOUGHNESS TESTING

ALLOY CONSTRAINT ¹ TEST DIRECTION ²	2024-T861 STIFFENED L T	2024-T861 UNSTIFFENED L T	2124-T851 UNSTIFFENED L T
THICKNESS	1.60 mm (.063 INCH) 3.18 mm (.125 INCH)	1.60 mm (.063 INCH) 3.18 mm (.125 INCH) 6.35 mm (.250 INCH)	6.35 mm (.250 INCH) 12.70 mm (0.50 INCH)
TEMPERATURE/ENVIRONMENT	144°K (-200°F)/N ₂ 298°K (70°F)/LAB AIR 450°K (350°F)/LAB AIR	144°K (-200°F)/N ₂ 298°K (70°F)/LAB AIR 450°K (350°F)/LAB AIR	144°K (-200°F)/N ₂ 298°K (70°F)/LAB AIR 450°K (350°F)/LAB AIR
INITIAL FLAW SIZE ³	SMALL MEDIUM LARGE	SMALL MEDIUM LARGE	SMALL MEDIUM LARGE
TOTAL SPECIMENS	36	54	36

¹ Stiffened: Teflon-coated guide plates used to restrain buckling.
Unstiffened: No guide plates used.

L: Longitudinal
T: Transverse

³ Initial flaw sizes selected to cause the largest possible spread in full section failure loads.

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effects of panel buckling, each stiffened and unstiffened test was conducted using companion specimens which contained identical initial flaw sizes.

Prior to fracture toughness testing, a sharp central notch was cut in each specimen using a 0.25 mm (0.010 inch) thick saw blade. In order to allow room for fatigue precracking, this notch was cut to a length approximately 12.7 mm (0.5 inch) less than the desired final flaw size and was of equal length on both sides of the 3.18 mm (0.125 inch) diameter starter hole. The flaw was then extended to the desired final length using axial fatigue at frequencies of 5 to 10 Hz and at loads that corresponded to approximately 50 percent of the estimated failure load. All fatigue precracking was performed using a Model 810.04A MTS system having a capacity of 0.45 MN (100,000 pounds).

3.2.2 Attainment of Environmental Conditions

To obtain the 144°K (-200°F) test temperature, a special environmental chamber was clamped about the central 45.7 cm (18 inches) of the specimen gage length; attaching the chamber so far away from the central crack permitted the thinner gage specimens to buckle when no stiffener plates were used. This chamber was constructed from two appropriately sized aluminum electrical chassis boxes that were lined with styrofoam insulation. Each chamber half contained a 20.3 cm (8 inch) diameter viewing port of thermopane glass. To cool the specimen to 144°K (-200°F), liquid nitrogen was introduced into the chamber; the amount introduced was controlled by a thermocouple taped to the specimen near the crack. This thermocouple was connected to a temperature controller, which was also connected to a solenoid valve that regulated the LN₂ flow. Using this procedure, chamber temperature was maintained within $\pm 2.8^{\circ}\text{K}$ ($\pm 5^{\circ}\text{F}$) of the desired 144°K (-200°F) temperature.

This environmental chamber was also used in an attempt to obtain the 450°K

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(350°F) environment; a hot air heat exchanger connected to the chamber served as the heat source. However, the desired 450°K (350°F) temperature could not be obtained using this technique. An alternate method was developed that employed quartz heating lamps positioned on one side of the specimen. To prevent heat loss, the opposite side of the specimen was covered with insulating material; a narrow slit in this material allowed attachment of the compliance gage and viewing of the crack throughout the test. Thermocouples taped to both sides of the specimen indicated a temperature differential of no more than 2.8°K (5°F) using this technique.

3.2.3 Fracture Toughness Testing

Two types of universal testing machines were used for the fracture toughness tests conducted under this program. When failure was expected to occur at loads below 445 kN (100,000 lbs), the MTS universal test system shown in Figure 3-7 was used. This closed-loop, servo-controlled test system was operated in the load-control mode and programmed for ramp loading; load output was monitored by a load cell positioned in the loading train. For specimens expected to fail at higher loads, a Baldwin universal testing machine with a capacity of 1.8 MN (400,000 lb) was used, as shown in Figure 3-8. In order to produce the required load signal during the test, this machine was modified by connecting the core of a linear position transducer (LVDT) to the dial indicator drive. The LVDT was then adjusted to produce a 10 volt output signal for a full-scale deflection of the testing machine's dial indicator.

Specimen testing was accomplished using a set of match-drilled grips. These grips were bolted to the ends of the specimen and connected to the appropriate testing machine using 63.5 mm (2.5 inch) diameter loading pins. After each specimen was installed in the test machine, a double-beam displacement gage was mounted on the knife edges previously attached to the specimen; the displacement

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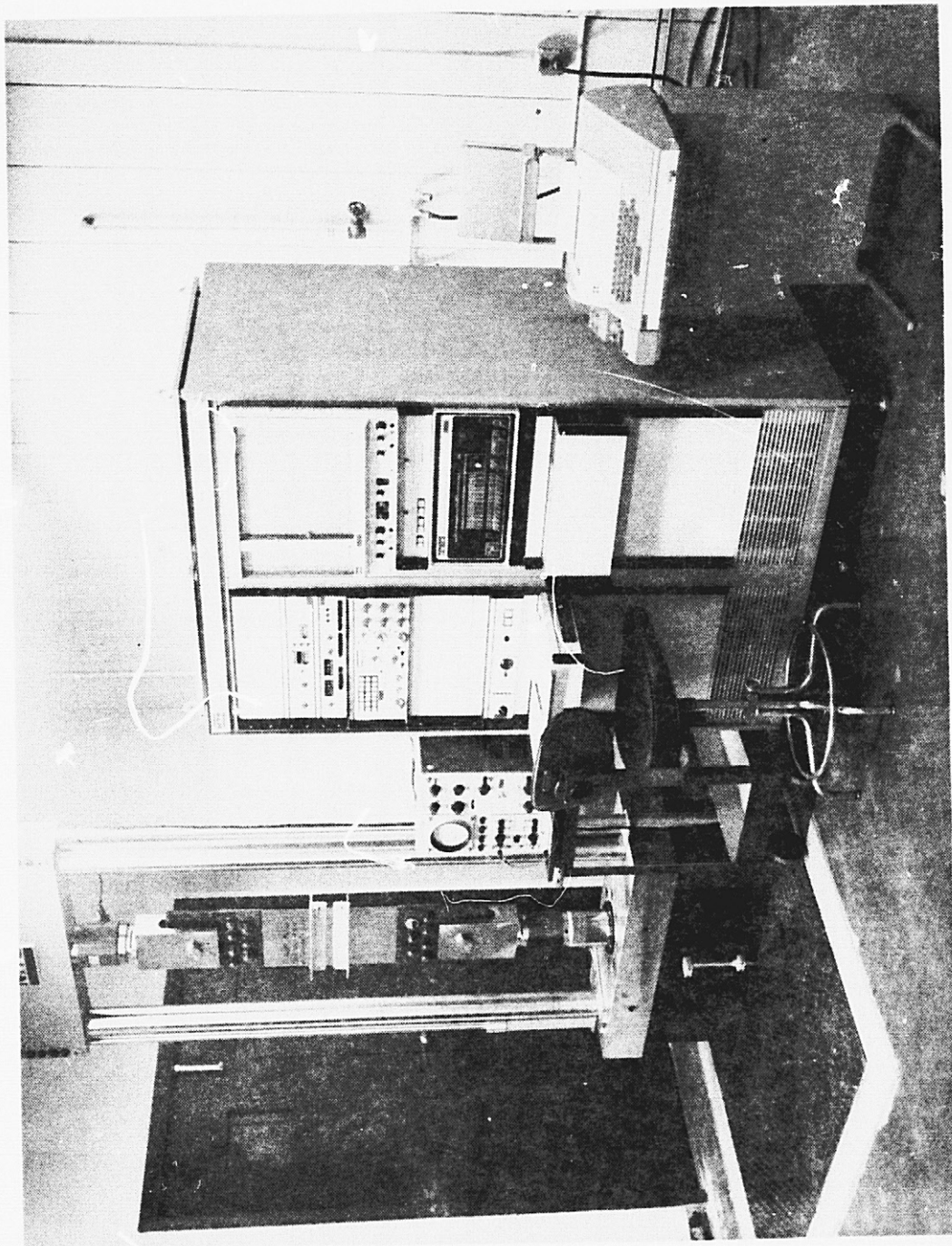


FIGURE 3-7
MTS UNIVERSAL TEST SYSTEM

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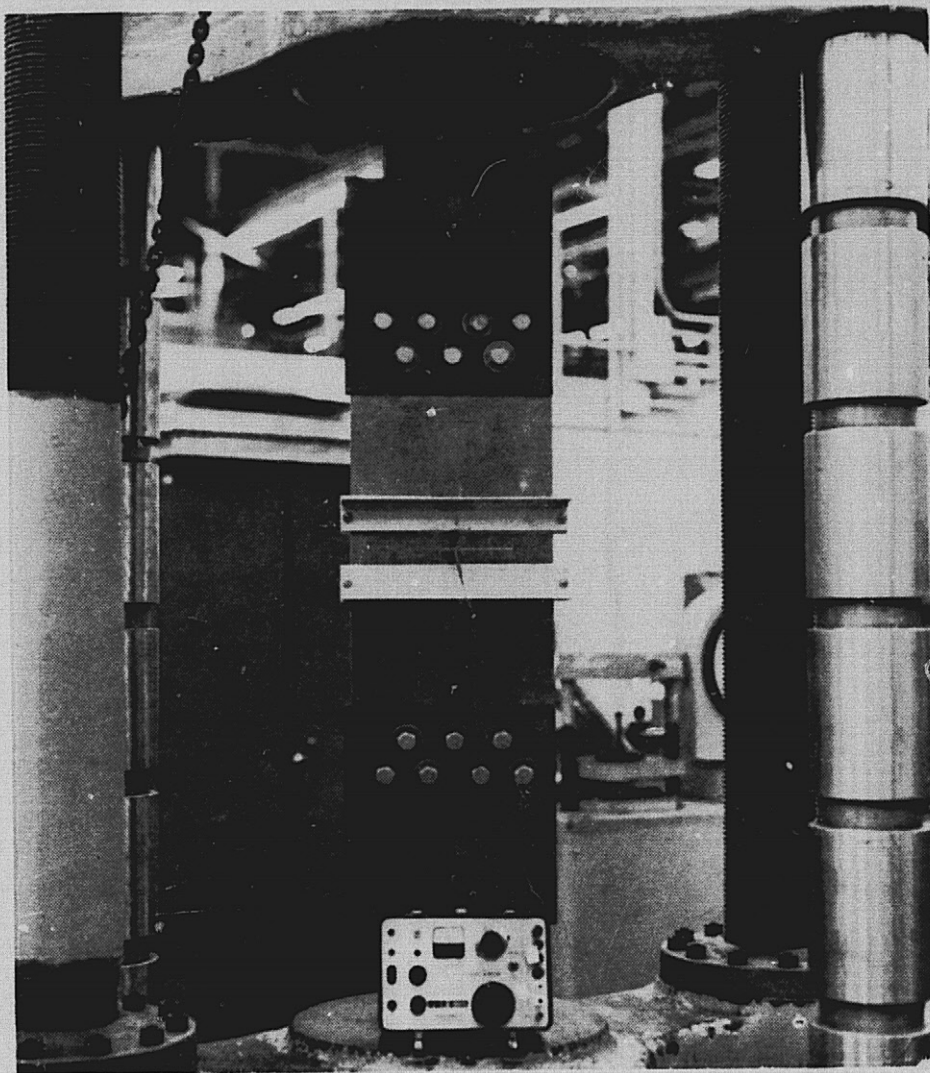


FIGURE 3-8

BALDWIN UNIVERSAL TESTING MACHINE USED FOR FRACTURE TOUGHNESS TESTING

gage and the attachment techniques employed were identical to those used for specimen compliance calibration, as described in Section 3.1. For those tests which required buckling effects to be suppressed, Teflon coated stiffener plates were clamped across the specimen width, above and below the flaw. For those tests not conducted at room temperature, the necessary environmental control equipment was mounted on or near the specimen and the required temperature obtained. For

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these tests, no load was applied for a period of 10 minutes in order to insure that thermal equilibrium was achieved. During testing, the load signal from the testing machine was connected to the Y-channel of an X-Y recorder; the displacement output from the displacement gage was connected to the X-channel. To compensate for the variation in the thickness of the specimens, the loading rate was adjusted to provide a constantly increasing stress rate of 96.5 MPa/minute (14 ksi/minute).

In most cases the load/COD curves obtained from these tests supplied all the information necessary to completely characterize the flaw growth and fracture process for each specimen. However, such load/COD data has been shown to be inadequate (Section 3.1) for tests of thin gage specimens where buckling was permitted. As a result, each of these tests was recorded on 16 mm motion picture film. Several techniques were used in an attempt to obtain a single film that would show both load and crack length throughout the test. The technique finally adopted was similar to that described in Reference 3-12 in which two cameras were employed - one to photograph the specimen and the other to photograph the X-Y recorder. Synchronized stop watches, placed in the field of view of each camera, enabled a correlation to be made between crack length and applied load to obtain stress intensity values. Repeated practice trials indicated that the stop watches could be synchronized to an accuracy of ± 0.1 second.

3.3 TEST RESULTS

3.3.1 The Crack Growth Resistance Concept

Under plane stress conditions, no singular value of critical stress intensity, K_{IC} , can be defined for all structural configurations; the amount of stable crack growth that occurs prior to failure is dependent not only upon the response of the material to the presence of a sharp crack under load, but also upon the geometry

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of the structure that contains the flaw. For any given configuration, the point of instability is unique and can be defined as that value of stress intensity where the applied stress intensity, K_i , balances the response of the material, K_R , to such crack growth. The K_C value for other structural configurations, however, is not necessarily identical, primarily because the relationship between stress intensity, applied load, and crack length is dependent on structure geometry.

For the center cracked tension specimen used in this program, the crack driving force for crack extension is described by equation (3-1); this equation defines a family of stress intensity/crack length curves for various values of applied load. If the crack growth resistance characteristics of the material are known (K_R), the point of instability, K_C , for this configuration occurs when the stress intensity factor at the crack tip, K_i , begins to increase more rapidly than K_R ; i.e., when

$$\left(\frac{\partial K_i}{\partial a} \right)_{\sigma=\sigma_C} = \left(\frac{\partial K_R}{\partial a} \right)_{\sigma=\sigma_C} \quad (3-9)$$

This condition, illustrated schematically in Figure 3-9, represents the point of tangency between the K_R curve and the unique K_i curve defined by

$$K_i = \sigma_C \sqrt{\pi a Z} \quad (3-10)$$

3.3.2 Data Reduction

In order to establish the K_R curve for all test conditions investigated, the load/COD data obtained from each fracture toughness test was converted into stress intensity/flaw size data using equations (3-1) and (3-6). The data was then plotted as stress intensity versus crack extension to develop fracture resistance curves for each alloy/thickness/temperature/orientation combination. These curves, together with the tabulated data, are collected in Appendix C; the room temperature K_R curves for both alloys in the longitudinal test direction are shown in Figure 3-10.

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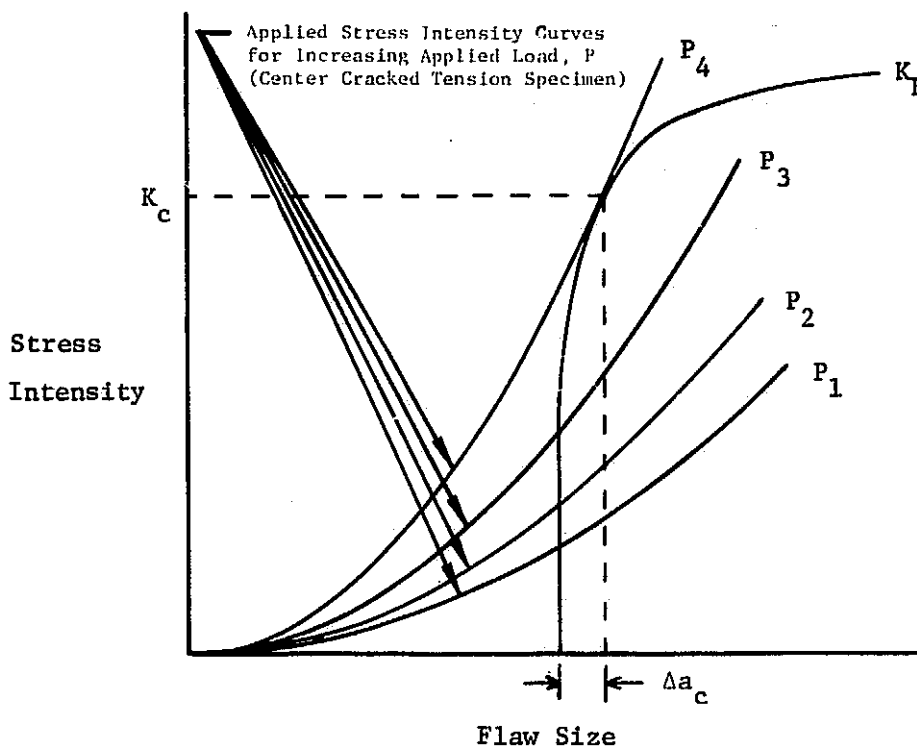


FIGURE 3-9

SCHEMATIC REPRESENTATION OF K_R AND APPLIED STRESS INTENSITY CURVES

For tests of several of the high temperature specimens, so much crack extension occurred prior to failure that the net section stress exceeded 90 per cent of the 0.2 per cent offset yield strength. For these tests, stress intensity data is reported only for those flaw sizes where the net section stress is less than $0.9 F_{ty}$. Such net section yielding during high temperature testing is an indication that the specimen width used was insufficient to promote conditions of crack instability.

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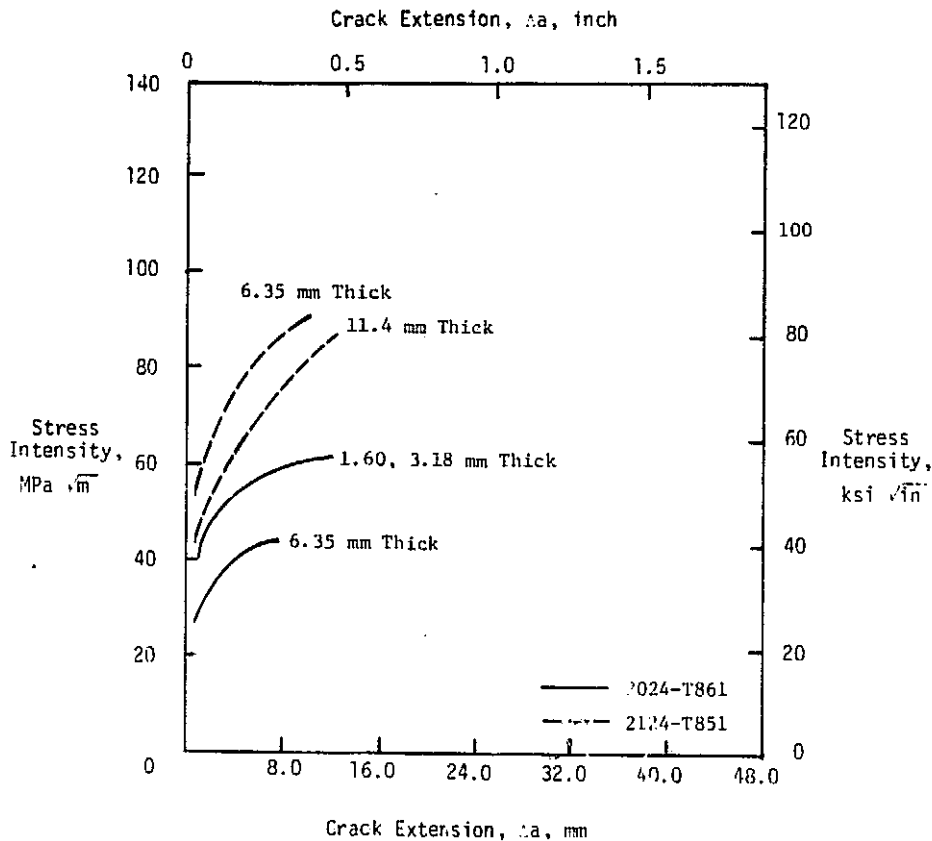


FIGURE 3-10

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CRACK GROWTH RESISTANCE CURVES FOR 2024-T861 AND 2124-T851

3.3.3 Data Analysis

The technique described in Section 3.3.1 was used to obtain critical stress intensity (K_{IC}) values from each fracture toughness test; this data is listed in Tables 3-3 and 3-4. These values represent those which satisfy the tangency condition described by equation (3-9) for each test condition. To obtain this data, the stress intensity/crack length test data was plotted as (K) versus (\sqrt{a}). Such a procedure was used because equation (3-1) becomes linear, thus allowing the tangency condition between it and the test data to be more easily established.

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Table 3-3

FRACTURE TOUGHNESS (K_{IC}) VALUES FOR 2024-T361 *

ALLOY	THICKNESS		TEMPERATURE		TEST DIRECTION	K_{IC}	
	mm	in	K	F		MPa \sqrt{m}	ksi \sqrt{in}
2124-T851	6.35	.250	144	-200	L	94.6	86.1
						86.0	78.3
						87.3	79.4
					AVG:	89.3	81.3
					T	76.4	69.5
						58.3	53.0
						56.7	51.6
					AVG:	63.1	58.0
			294	70	L	100.0	91.0
						84.6	77.0
						77.4	70.4
					AVG:	87.2	79.5
					T	54.7	49.8
						52.9	48.2
						58.9	53.6
					AVG:	55.5	50.5
	11.45	.450	144	-200	L	114.6	104.3
						78.3	71.2
					AVG:	96.5	87.8
					T	47.7	43.4
						43.9	39.9
						41.9	38.1
					AVG:	44.5	40.5
			294	70	L	88.1	80.2
						70.1	63.8
					AVG:	79.1	72.0
					T	51.9	47.2
						45.4	41.3
						36.1	33.0
					AVG:	44.5	40.5

* From Appendix C.

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Table 3-4

FRACTURE TOUGHNESS (K_{IC}) VALUES FOR 2124-T851

ALLOY	THICKNESS		TEMPERATURE		TEST DIRECTION	K_{IC} MPa \sqrt{m}	K_{IC} ksi \sqrt{in}
	mm	in	K	F			
2024-T861	1.60	.063	144	-200	L	61.4	55.9
						55.4	50.4
						<u>58.4</u>	<u>53.2</u>
					AVG:	58.4	53.2
					T	44.1	40.2
						<u>50.3</u>	<u>45.8</u>
					AVG:	60.9	55.4
	294	70			L	61.0	55.5
						56.7	51.6
						<u>65.0</u>	<u>59.2</u>
					AVG:	60.9	55.4
					T	56.1	51.1
						52.6	47.8
						<u>49.7</u>	<u>45.2</u>
					AVG:	52.8	48.0
	3.18	.125	144	-200	L	51.9	47.2
						56.1	51.1
						<u>51.0</u>	<u>46.4</u>
					AVG:	53.0	48.2
					T	38.3	34.8
						36.0	32.8
						<u>37.7</u>	<u>34.3</u>
					AVG:	37.5	34.0
	294	70			L	68.3	62.1
						58.1	52.9
						55.5	50.5
						<u>58.6</u>	<u>53.3</u>
					AVG:	60.1	54.7
					T	46.4	42.3
						43.8	39.9
						<u>43.7</u>	<u>39.8</u>
					AVG:	44.6	40.7
	6.35	.250	144	-200	L	35.1	32.0
						38.9	35.4
						<u>35.4</u>	<u>32.2</u>
					AVG:	36.5	33.2
					T	30.7	28.0
						28.3	25.7
						<u>32.1</u>	<u>29.3</u>
					AVG:	30.4	27.7
	294	70			L	43.6	39.7
						42.1	38.4
						45.4	46.3
					AVG:	43.7	39.8
					T	32.5	29.6
						32.9	29.9
						<u>35.7</u>	<u>32.5</u>
					AVG:	33.7	30.7
	450	350			L	95.9	87.2
						96.4	87.8
						<u>89.0</u>	<u>81.0</u>
					AVG:	93.8	85.3
					T	68.3	61.4
						75.7	68.9
						<u>67.9</u>	<u>61.8</u>
					AVG:	70.6	64.0

* From Appendix C.

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No finite width correction factor need be applied to such plots, since this factor has already been incorporated in the reduction of the fracture toughness test data. Such curves, as well as the stress intensity, crack extension curves shown in Appendix C, represent the fracture characteristics of an infinitely wide center cracked tension specimen.

3.4 DISCUSSION

Examination of the data in Appendix C shows that the test variables studied exert a strong influence on the plane stress fracture toughness of the materials investigated. The effects of each of the test variables are discussed below, in the order they appear in Table 3-2.

3.4.1 Effect of Alloy Composition/Heat Treatment.

The effect of this variable on fracture toughness is shown in Figure 3-11, which shows that, for equivalent section thicknesses, the K_{IC} values for 2124-T851 alloy are almost twice those of the 2024-T861 alloy. The higher toughness of the 2124-T851 material can be attributed to the combined effect of its higher purity and its different thermo-mechanical processing relative to the T861 condition. Both effects must be active, since other data (Reference 3-13) indicates that the plane strain fracture toughness (K_{IC}) of 2124-T851 plate are superior to those of comparable 2024-T861 plate.

3.4.2 Effect of Panel Constraint.

It has been observed (Reference 3-9) that the large out-of-plane deflections associated with the buckling of a thin center-cracked tension specimen under load can significantly reduce its static tensile strength relative to the strength of similar specimens tested with such deflections suppressed by stiffener plates. In the present study, no such strength reductions were observed for the cryogenic and

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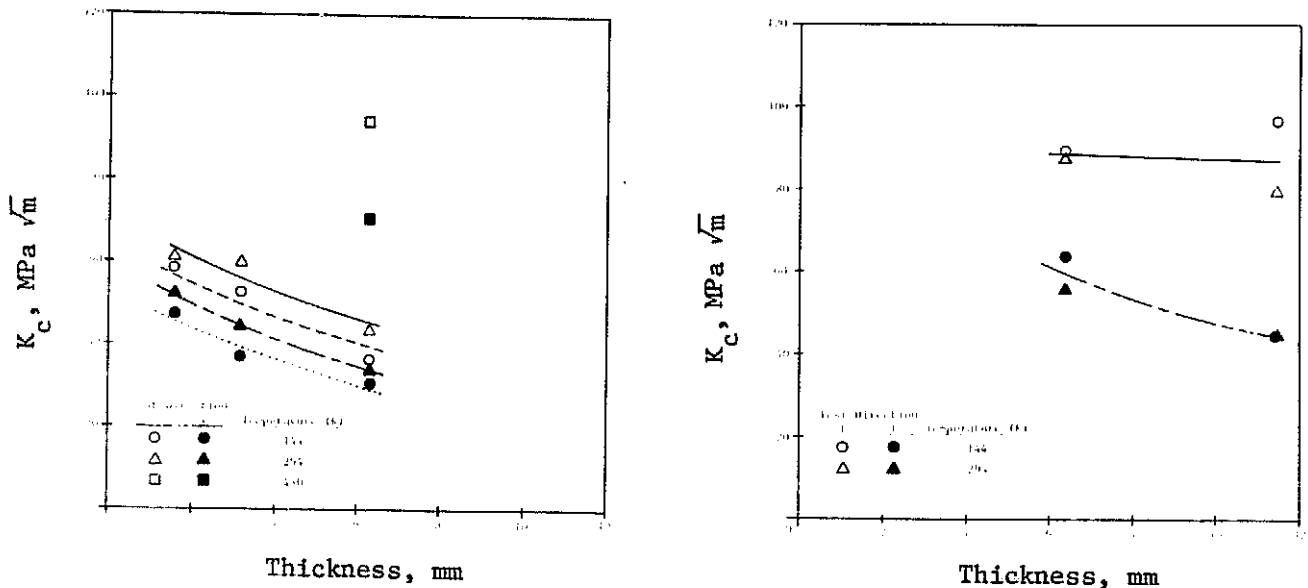


FIGURE 3-11

EFFECT OF THICKNESS ON THE PLANE STRESS FRACTURE TOUGHNESS OF 2024-T861 AND 2124-T851

room temperature tests of unstiffened thin gage specimens (see Figure 3-12). The lack of sensitivity of this test data to the presence or absence of buckling restraints during testing can only be attributed to the lack of significant out-of-plane deflections in the specimens prior to failure.

The fact that buckling effects were absent in most of these tests can be confirmed through an analysis of the interrelationship between crack instability and the stress required to cause buckling. The net section stress, σ_n , required to cause buckling has been shown (Reference 3-14) to agree quite well with that predicted by the following equation, obtained from Reference 3-15:

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$$\sigma_n = \frac{\pi^2 E t^2}{12 l_e^2} \quad (3-11)$$

where l_e = effective total crack length.

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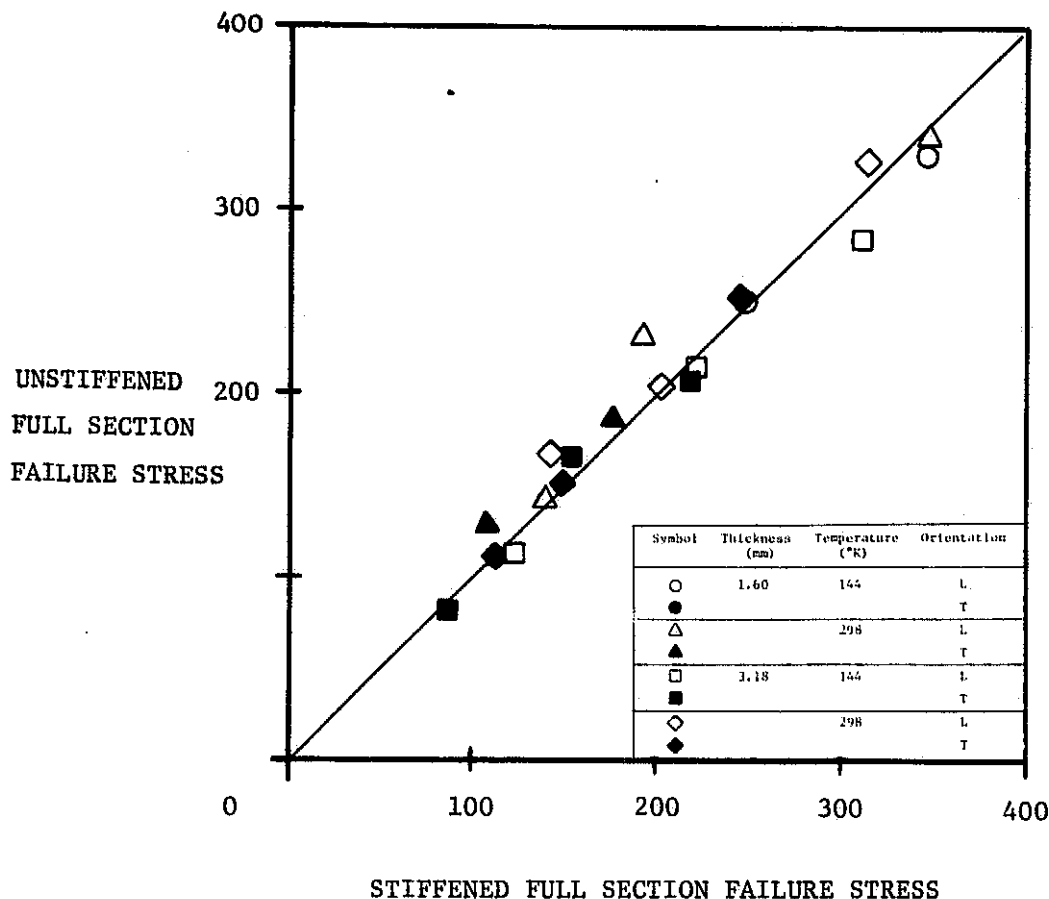


FIGURE 3-12

EFFECT OF STIFFENING ON THE FULL SECTION FAILURE STRESS OF 2024-T861
(constant initial flaw size)

The results obtained in Reference 3-14 indicate that l_e has a value between 33 and 50 percent of the actual total crack length, $2a$. The net section stress can also be derived for conditions of crack instability from equation 3-1:

$$\sigma_n = \left(\frac{w}{w-2a} \right) \left(\frac{K_c}{\sqrt{\pi a Z}} \right) \quad (3-12)$$

Provided K_c is known, equations (3-11) and 3-12) can be used to develop a plot of net section stress as a function of total crack length for a given specimen size.

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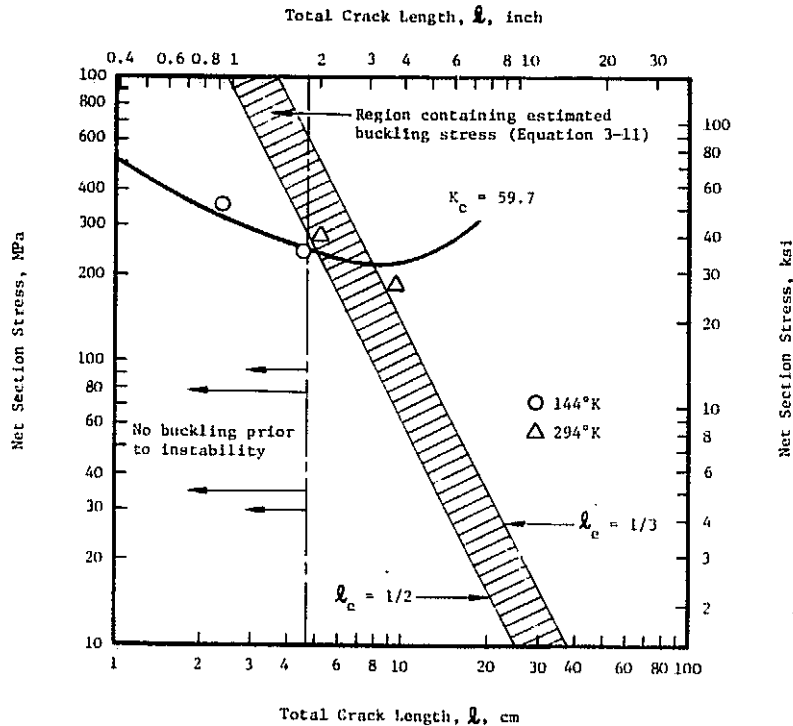


FIGURE 3-13

NET SECTION STRESS AS A FUNCTION OF TOTAL CRACK LENGTH FOR
UNSTIFFENED 1.60 MM (.063 INCH) THICK 2024-T861 SPECIMEN

Such a plot is shown in Figure 3-13 for 2024-T861 having a nominal thickness of 1.60 mm (.063 inch) and a K_c value of 59.7 MPa \sqrt{m} (54.3 ksi \sqrt{in}); the latter value was obtained by averaging the cryogenic and room temperature K_c data obtained from tests of the corresponding stiffened specimens. It should be noted that the intersection of the crack instability curve with the lower bound of the buckling stress region defines the minimum total flaw size at which buckling will occur prior to failure. For the conditions shown, this minimum total flaw size is approximately 4.8 cm (1.9 inch) or a value of $2a/w$ of approximately 0.10. Also shown in Figure 3-13 is the unstiffened test data for which critical crack length values are available.

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From Figure 3-13 it can be seen that most of the flaw sizes associated with the unstiffened test data fall below the minimum buckling flaw size. Such results show that in most cases, buckling did not occur during the testing of these unstiffened specimens. For one test, however, the flaw size at failure was approximately twice the minimum buckling flaw size (see Table C2-9, Appendix C). This specimen did buckle prior to failure, since its strength was reduced approximately 10 percent relative to that of the corresponding stiffened specimen (see Table C1-13, Appendix C). Since equation (3-11) is a function of (thickness)², the minimum buckling flaw size for the thicker 3.18 mm (.125 inch) unstiffened specimens is approximately four times larger than that for the thinner 1.60 mm (.063 inch) specimens. As a result, buckling effects were entirely absent during the testing of these thicker unstiffened specimens. It can be concluded, therefore, that because of the relatively low toughness of 2024-T861 when compared to lower strength alloys, buckling is likely to have little effect of the fracture behavior of this material at cryogenic and room temperatures for gages as thin as 1.60 mm (.063 inch).

3.4.3 Effect of Test Direction.

Figure 3-11 also shows that, for all thickness/alloy combinations, transverse K_{IC} values are approximately 15-20 percent lower than the corresponding longitudinal value.

3.4.4 Effect of Section Thickness.

The effect of section thickness is shown in Figure 3-11, which contains the average K_{IC} data shown in Table 3-3. For the 2024-T861 alloy, increasing section thickness from 1.60 to 6.35 mm (.063 to .250 inch) causes an approximate 30 percent decrease in fracture toughness at temperatures of 144°K and 294°K (200°F and 70°F). For 2124-T851, section thicknesses in the range of 6.35 to 11.45 mm (.250 to .450 inch) cause a less severe reduction (approximately 13 percent) in toughness.

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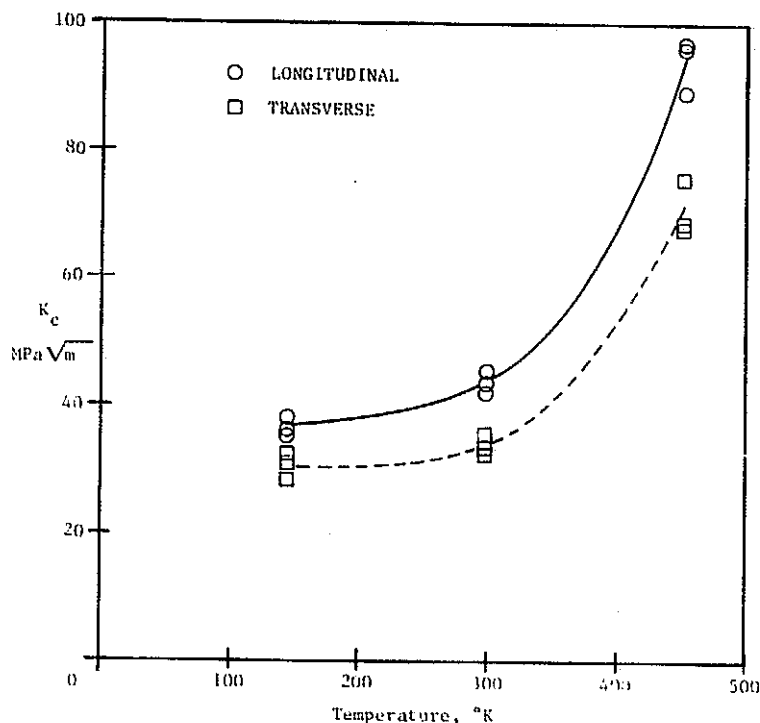


FIGURE 3-14

EFFECT OF TEMPERATURE ON THE PLANE STRESS FRACTURE TOUGHNESS FOR 2024-T861

3.4.5 Effect of Test Temperature.

The effect of test temperature on K_c is not immediately apparent from Figure 3-11, due to the lack of data at 450°K (350°F); the determination of an accurate K_c value at this temperature was in most instances precluded by net section yielding. However, the fracture toughness of 6.35 mm (.250 inch) thick 2024-T861 at this temperature was low enough to permit an accurate measurement with the specimen geometry employed in this program. The variation of K_c with temperature for this alloy/thickness combination is shown in Figure 3-14; from this figure it is apparent that the 450°K (350°F) K_c value for this alloy is twice that at room temperature. Conversely, this figure, as well as Figure 3-11, indicate that the toughness at 144°K (-200°F) is decreased approximately 20 percent relative to the room temperature value.

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3.4.6 Effect of Initial Flaw Size.

Examination of the data listed in Tables 3-3 and 3-4 shows no systematic variation of critical stress intensity with initial flaw size for any test condition investigated. These results were obtained for crack length to specimen width ratios ($2a/w$) between .03 and .35.

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Section 4 CYCLIC FLAW GROWTH TESTING

A total of 258 center cracked tension specimens were tested during this phase of the program. A detailed test matrix is presented in Table 4-1.

4.1 TEST PROCEDURE

4.1.1 Selection of Cyclic Stress Levels

The maximum cyclic stress levels selected for use in this phase of the program are summarized in Table 4-2. Each specimen was tested at a unique stress level, and two to three stress levels were investigated for each alloy/thickness/orientation/stress ratio/environment combination. One of these stress levels was held constant for each alloy tested in order to compare cyclic life for a constant initial flaw size. The other stress levels were selected as a certain percentage of the 0.2 percent offset yield strength.

4.1.2 Attainment of Environmental Conditions

The equipment and procedures used to obtain the cryogenic and elevated temperatures for cyclic flaw growth testing were identical to those used for fracture toughness testing (Section 3.2.2). To obtain the room temperature environmental conditions, a plastic chamber was attached to the central 15.2 cm (6.0 inches) of the specimen gage length. Because both stiffened and unstiffened thin gage specimens were to be tested, two types of environmental chambers were employed. For tests where buckling effects were to be suppressed, an integral stiffener/environmental chamber was constructed from two pieces of plexiglass and

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Table 4-1

TEST MATRIX FOR CYCLIC FLAW GROWTH TESTING

ALLOY CONSTRAINT ¹ TEST DIRECTION ²	2024-T861 STIFFENED L T	2024-T861 UNSTIFFENED L T	2124-T851 UNSTIFFENED L T
THICKNESS	1.60 mm (.063 INCH) 3.18 mm (.125 INCH)	1.60 mm (.063 INCH) 3.18 mm (.125 INCH) 6.35 mm (.250 INCH)	6.35 mm (.250 INCH) 12.70 mm (.500 INCH)
TEMPERATURE/ENVIRONMENT	144°K (-200°F)/N ₂ 298°K (70°F)/ARGON 298°K (70°F)/WET AIR 422°K (300°F)/LAB AIR 450°K (350°F)/LAB AIR 478°K (400°F)/LAB AIR	144°K (-200°F)/N ₂ 298°K (70°F)/ARGON 298°K (70°F)/WET AIR 422°K (300°F)/LAB AIR 450°K (350°F)/LAB AIR 478°K (400°F)/LAB AIR	144°K (-200°F)/N ₂ 298°K (70°F)/ARGON 298°K (70°F)/WET AIR 422°K (300°F)/LAB AIR 450°K (350°F)/LAB AIR 478°K (400°F)/LAB AIR
APPLIED STRESS ³	LOW MEDIUM HIGH	LOW MEDIUM HIGH	LOW MEDIUM HIGH
CYCLIC FREQUENCY	200	20 200	20 200
STRESS RATIO ⁴	.05 150	.05	.05 .50
TOTAL SPECIMENS:	72	81	105

1 STIFFENED: TEFLON-COATED GUIDE PLATES USED TO RESTRAIN BUCKLING.
UNSTIFFENED: NO GUIDE PLATES USED

2 L: LONGITUDINAL
T: TRANSVERSE

3 SEE TABLE 4-2 FOR ACTUAL STRESS LEVELS USED.

4 RATIO OF MINIMUM TO MAXIMUM APPLIED STRESS.

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Table 4-2

STRESS LEVELS SELECTED FOR CYCLIC TESTING

ALLOY	TEST DIRECTION	TEST TEMPERATURE		FULL SECTION STRESS, σ_G		F_{TY}		σ_G/F_{TY}
		$^{\circ}K$	$^{\circ}F$	MPa	ksi	MPa	ksi	
2024-T861	L	144	-200	118.6	17.2	563.3	81.7	0.21
				168.9	24.5			0.30
		294	70	75.2	10.9	501.3	72.7	0.15
				118.6	17.2			0.23
				225.5	32.7			0.40
		422	300	118.6	17.2	-	-	-
	T	450	350	118.6	17.2	391.6	56.8	0.30
				195.8	28.4			0.50
				302.7	43.9			0.75
		478	400	118.6	17.2	-	-	-
		144	-200	118.6	17.2	550.9	79.7	0.22
				164.8	23.9			0.30
		294	70	118.6	17.2	496.4	72.0	0.24
				148.9	21.6			0.30
				198.6	28.8			0.40
		422	300	118.6	17.2	-	-	-
		450	350	118.6	17.2	391.6	56.8	0.30
				195.8	28.4			0.50
				302.7	43.9			0.75
		478	400	118.6	17.2	-	-	-
2124-T851	L	144	-200	217.2	31.5	534.4	77.5	0.41
				293.7	42.6			0.55
		294	70	144.1	20.9	479.2	69.5	0.30
				217.2	31.5			0.45
				335.8	48.7			0.70
		422	300	144.8	21.0	-	-	-
	T	450	350	108.9	15.8	362.0	52.5	0.30
				217.2	31.5			0.60
				307.5	44.6			0.85
		478	400	144.8	21.0	-	-	-
		144	-200	217.2	31.5	506.8	73.5	0.43
				278.6	40.4			0.55
		294	70	140.0	20.3	465.4	67.5	0.30
				217.2	31.5			0.47
				325.8	47.3			0.70
		422	300	144.8	21.0	-	-	-
		450	350	108.9	15.8	362.0	52.5	0.30
				217.2	31.5			0.60
				307.5	44.6			0.85
		478	400	144.8	21.0	-	-	-

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the stiffener plates used for suppressing buckling effects during fracture toughness testing. Teflon was used to completely seal the plexiglass panes to the surfaces of the specimen. The required gas (argon or water-saturated air) was bled into the chamber on one side of the specimen and exhausted through a small hole in the plexiglass on the opposite side. For tests of thin gage specimens where buckling was permitted, a flexible environment chamber was fabricated from two sheets of mylar sealed to the specimen surface using a relatively thick layer of putty. Rubber hoses embedded in the putty on opposite sides of the specimen permitted argon gas or water saturated air to enter and leave the chamber.

To attain the water-saturated air environment, filtered compressed air was bubbled through a bottle containing distilled water. Relative humidity readings of 95 to 100 percent were obtained by passing this airstream through a bell jar containing a stationary wet and dry bulb hygrometer. Bottled argon, having a dew point of 210°K (-82°F), was used to obtain an inert environment. Prior to test, the chamber was purged by bleeding the argon or water-saturated air through the chamber at a relatively high flow rate for five minutes.

4.1.3 Cyclic Flaw Growth Testing

One of three types of closed loop, electro-hydraulic universal testing machines was employed for testing the specimens under this program. For those specimens requiring low cyclic loads (less than 222 kN, or 50,000 lbs.), the MTS universal testing system, operated in the load control mode, was used. For those specimens requiring higher loads, hydraulic fatigue machines with capacities of 667 kN (150,000 lbs.) and 1.33 MN (300,000 lbs.) were used. These machines were also operated in the load control mode; a loading accuracy of two percent was obtained using closed loop servo controls employing the principle of variable gain feedback. These controls employ linear variable feedback amplifiers

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that were adjusted for a predetermined feedback voltage using a calibrated resistor shunted across the load cell bridge. All load signals were monitored with a strip chart recorder and an oscilloscope.

Each specimen was installed in the appropriate testing machine after a starter notch was introduced using a 0.25 mm (0.010 inch) thick saw blade. The proper environmental equipment was then placed around or near the specimen. A photo of the test setup for a cryogenic test is shown in Figure 4-1. Once the proper environmental conditions were obtained for each test, cycling was initiated using sinusoidal loading at constant amplitude. When a fatigue crack was observed emanating from each side of the sawcut, cycling was temporarily halted while a measurement of total crack length to the nearest 0.025 mm (0.001 inch) was made with a coordinate cathetometer. Such measurements, made approximately every 1.27 mm (0.050 inch) of crack extension, were continued until each specimen failed.

These intermittent crack length measurements were supplemented with 16 mm motion picture records of each specimen that allowed crack length measurements to be obtained up to specimen failure. Such movies were obtained using a pulsed movie camera that was triggered each time the specimen reached peak load. Because of the relatively slow shutter speed of the camera, the motion of the specimen was frozen by a strobe light; the position of the strobe and the lens aperture was controlled in such a way as to prevent ambient light from exposing the film while the shutter was open. A ruler or a transparent plastic grid was taped to the specimen to allow crack length measurements to be made from the film.

4.2 TEST RESULTS

Because no standard technique has yet been established to reduce and analyze raw cyclic specimen data, several techniques were considered. The following

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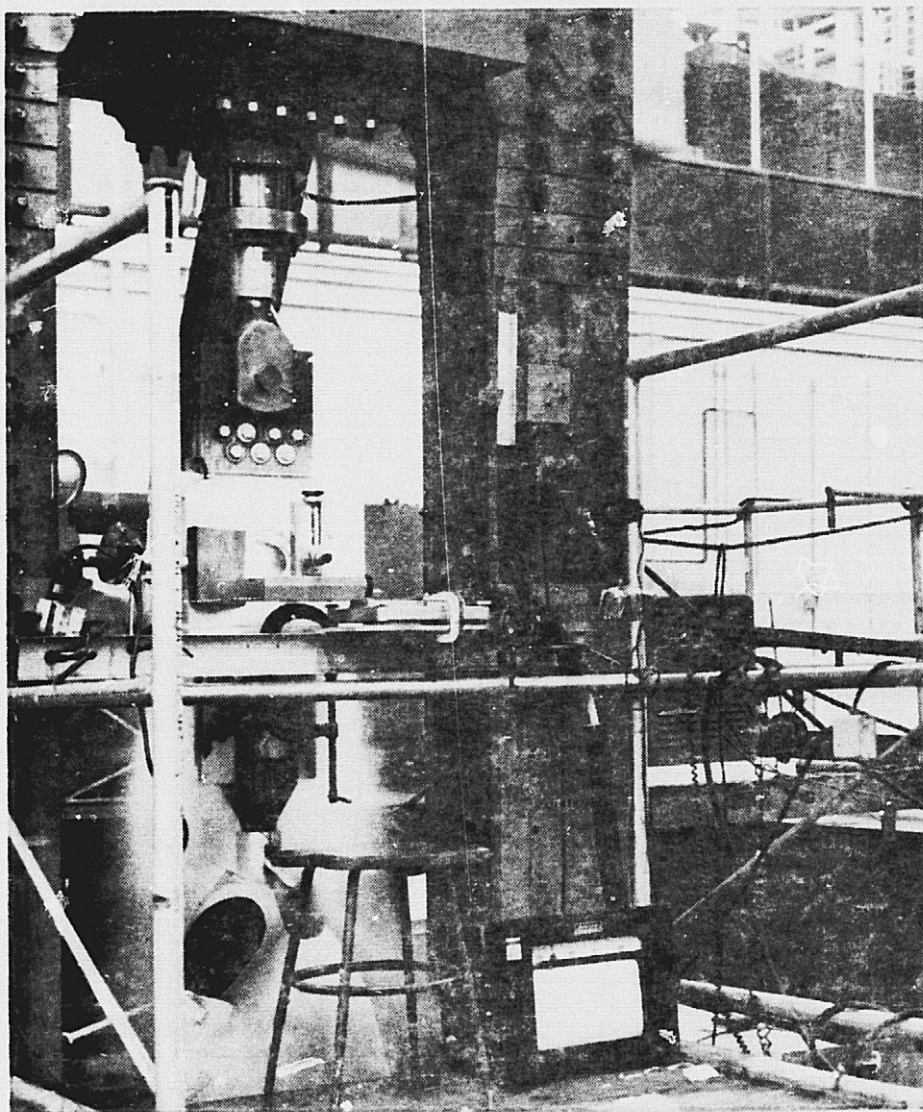


FIGURE 4-1

TEST SETUP FOR CRYOGENIC FATIGUE FLAW GROWTH TESTING

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sections describe the techniques finally adopted; Appendix F contains a description and evaluation of the other methods considered.

The cyclic test data obtained under this phase of the program is presented in Appendix D in both tabular and graphical formats. For tests of several of the high temperature specimens, the flaw size was found to be come so large prior to failure that the net section stress exceeded 90 percent of the 0.2 percent offset yield strength. For these tests, growth rate/stress intensity data is reported only for those flaw sizes for which the net section stress is less than $0.9 F_{ty}$. No such data is reported for larger flaw sizes, since the stress intensity approach is based on elastic conditions prior to instability.

4.2.1 Data Reduction

Because of the great quantity of data generated during this phase of the program, computer techniques were employed to reduce and analyze the test data. The raw crack length/cycle measurements obtained during each test were recorded directly on computer coding forms; tab cards were keypunched from these records and given a preliminary analysis by a specially developed computer program entitled ACCE (for "Analysis of Cyclic Crack Extension"). This program has the capability of examining the raw data and checking it for transcription errors and other inconsistencies. Once these errors are liminated, the derivative, da/dN , is approximated using a divided difference:

$$\frac{da}{dN} \approx \frac{(a_{n+1} - a_n)}{N_{n+1} - N_n} \quad (4-1)$$

The corresponding average stress intensity range, ΔK , is computed using the relation:

$$\Delta K = \Delta \sigma \sqrt{\pi a_{avg}} \cdot Z \quad (4-2)$$

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$$\text{where } \Delta\sigma = \sigma_{\max} - \sigma_{\min}$$

$$a_{\text{avg}} = (a_{n+1} + a_n)/2$$

$$Z = \sec(\pi a_{\text{avg}}/W)$$

Also included in this program is a Calcomp plotting routine that plots the resulting $(\Delta a/\Delta N, \Delta K)$ data on log-log coordinates. The data from each specimen was then analyzed visually to detect and eliminate, if possible, any abrupt discontinuities in flaw growth rate. Such discontinuities were found to be caused by a minor transcription error or by too small an interval (less than 0.76 mm, or 0.030 inch) between any two successive crack length measurements. The latter type of discontinuity is likely to be related to the nonhomogeneous nature of the fatigue crack growth process in real materials at the microscopic level.

4.2.2 Data Analysis Techniques

The cyclic test data shown in Appendix D was analyzed to determine the parameters associated with either of the following two empirical flaw growth rate models:

$$\text{Forman (Reference 4-1): } \frac{da}{dN} = \frac{C \Delta K^n}{(1-R)K_C - \Delta K} \quad (4-3)$$

where C, n = Forman rate equation constants

R = ratio of minimum to maximum stress

K_C = critical stress intensity

$$\text{Collepriest (Reference 4-2): } \frac{da}{dN} = C_1 \text{ EXP} \left[C_2 \tanh^{-1} \phi \right] \quad (4-4)$$

where C_1, C_2 = rate equation constants

$$\phi = \frac{\ln(\Delta K^2 / (1-R) K_C \Delta K_0)}{\ln((1-R) K_C / \Delta K_0)}$$

ΔK_0 = threshold stress intensity range

A third model, originally proposed by Paris (Reference 4-3) was not used,

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primarily because of its inability to account for the high growth rates that occur prior to instability. This model has the form:

$$\frac{da}{dN} = C \Delta K^n \quad (4-5)$$

where C, n = Paris rate equation constants

Although the Paris model was not directly incorporated into the data analysis procedure, the Paris rate equation constants were indirectly evaluated by using an alternate form of equation (4-4). As first proposed (Reference 4-4), this equation had the more lengthy form:

$$\frac{da}{dN} = C (K_c \Delta K_o)^{n/2} \exp \left[\ln(K_c / \Delta K_o)^{n/2} \right] \cdot \operatorname{arctanh} \left(\frac{\ln \left[\Delta K^2 / \{ (1-R) K_c \Delta K_o \} \right]}{\ln (1-R) K_c / \Delta K_o} \right) \quad (4-6)$$

The constants C_1 and C_2 in equation (4-4) are related to the Paris equation constants by:

$$C_2 = \ln \left(\frac{K_c}{\Delta K_o} \right)^{n/2} \quad (4-7)$$

$$C_1 = C (K_c \Delta K_o)^{n/2} \quad (4-8)$$

Evaluation of the rate constants for equations (4-3) and (4-4) would ordinarily involve complex non-linear regression techniques. These equations can be transformed into linear form using logarithms; however, such transformations can introduce error, the sources of which are described in Appendix F. In its linear form, equation (4-3) can be rewritten as:

$$\ln \left[\frac{da}{dN} \cdot \left\{ (1-R) K_c \Delta K \right\} \right] = \ln C + n \ln \Delta K \quad (4-9)$$

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The linear equivalent of equation (4-4) is:

$$\ln \frac{da}{dN} = \ln C_1 + C_2 \cdot \tanh^{-1} \phi \quad (4-10)$$

Evaluation of the rate constants in equations (4-9) and (4-10) can easily be performed using an ordinary least squares analysis, provided values of K_C and ΔK_0 are supplied. The former value is usually obtained from a fracture toughness test, while the latter is an estimated value. However, in order to obtain an independent measure of these values, a special computer program was developed to optimize not only the rate constants but also the K_C value and, for equation (4-8), the value of ΔK_0 for each data set. This program, entitled RACD (for "Regression Analysis of Cyclic Data"), is designed to optimize the rate constants using least square techniques; iterative convergence routines are then used to determine the value of K_C and/or ΔK_0 that produces the best fit of each equation to the experimental data. The convergence routines employed are an extension to multiple dimensions of a one-dimensional root finder; this root finder is based upon a combination of the secant method (Reference 4-5) and Aitken's delta squared procedure (Reference 4-6). The procedure involves evaluating the rate constants for each model using least squares techniques and an assumed value for K_C and, when necessary, ΔK_0 . Once obtained, the total amount of error between this computed curve and each data point (i.e., the sum of the residuals) is computed using the relation,

$$r_i = \sum \left[\left(\frac{da}{dN} \right)_m - \left(\frac{da}{dN} \right)_c \right]^2 \quad (4-11)$$

where $\left(\frac{da}{dN} \right)_m$ = "measured" value of flaw growth rate
(i.e., using equation 4-1)

$\left(\frac{da}{dN} \right)_c$ = calculated value of flaw growth rate

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Table 4-3

EQUATIONS USED FOR CONVERGENCE ANALYSIS OF CYCLIC TEST DATA

FLAW GROWTH RATE MODEL	PARAMETER OPTIMIZED	EQUATION SATISFIED
Forman (Equation 4-9)	K_C	$\frac{\partial r}{\partial K_C} = 0 = \sum_i \left\{ (1-R) \left(\frac{da}{dN} \right)_i \ln \left(\frac{da}{dN} \right)_i - (\ln C + n \ln(\Delta K)_i) \right\}$
Collepriest (Equation 4-10)	K_C	$\frac{\partial r}{\partial K_C} = 0 = \sum_i \left\{ \frac{C_2}{1-\phi_i^2} \left(\frac{-\ln \left(\frac{(1-R) K_C \Delta K_0}{2 K_C \ln \left(\frac{(1-R) K_C}{\Delta K_0} \right)} \right)}{K_C \ln \left(\frac{(1-R) K_C}{\Delta K_0} \right)} \right) \left(\ln \left(\frac{da}{dN} \right)_i - (\ln C_1 + C_2 \tanh^{-1}(\phi)_i) \right) \right\}$
	ΔK_0	$\frac{\partial r}{\partial \Delta K_0} = 0 = \sum_i \left\{ \frac{C_2}{1-\phi_i^2} \left(\frac{\ln \left(\frac{(1-R) K_C \Delta K_0}{2 K_C \ln \left(\frac{(1-R) K_C}{\Delta K_0} \right)} \right)}{\Delta K_0 \ln \left(\frac{(1-R) K_C}{\Delta K_0} \right)} - \frac{1}{\Delta K_0 \ln \left(\frac{(1-R) K_C}{\Delta K_0} \right)} \right) \left(\ln \left(\frac{da}{dN} \right)_i - (\ln C_1 + C_2 \tanh^{-1}(\phi)_i) \right) \right\}$

$$\text{where } \phi = \frac{\ln((\Delta K)_i / ((1-R) K_C \Delta K_0))}{\ln((1-R) K_C / \Delta K_0)}$$

Equation (4-11) can be rewritten using the appropriate rate model expression for $(da/dN)_C$; best fit values for K_C were obtained by finding that value which satisfied the following condition:

$$\frac{\partial r}{\partial K_C} = 0 \quad \text{ORIGINAL PAGE IS OF POOR QUALITY} \quad (4-12)$$

Similarly, the best fit values for ΔK_0 were obtained by finding the value such that:

$$\frac{\partial r}{\partial \Delta K_0} = 0 \quad (4-13)$$

The exact form of Equation (4-12) and (4-13) used are summarized in Table 4-3.

While using this program, it was found that convergence was not always obtained for each data set. In some cases, failure to converge on a K_C value was caused by insufficient data at the high ΔK levels; conversely, failure to converge on a ΔK_0 value was caused by insufficient data at the low ΔK levels. In other cases, failure to converge was caused by a high degree of scatter in the data. The results of this analysis are collected in Appendix E.

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4.3 DISCUSSION

4.3.1 Effect of Cyclic Test Variables

Examination of the data in Appendix D shows that several common trends can be established, and that the effect of the eight test variables can be classified as to their general effect on the shape of the flaw growth rate curve. For example, such variables as specimen thickness, test direction, stress ratio, and buckling constraint all exert a similar influence on the flaw growth rate curve in that they primarily affect flaw growth rate at the high ΔK levels preceding instability. These particular test variables appear to affect fatigue flaw growth by altering the fracture toughness of the material (e.g., test direction) or by changing the stress pattern imposed on the specimen (e.g., thickness, stress ratio, and buckling). On the other hand, variables such as test temperature and alloy/heat treatment affect the flaw growth rate over the entire ΔK range. These test variables appear to affect the very nature of the cyclic flaw growth process. The effect of each test variable is discussed in greater detail below.

Effect of Alloy Composition/Heat Treatment. The effect of this test variable on flaw growth rate is shown in Figure 4-2. It can be observed that for constant values of ΔK , crack propagation occurs at a faster rate in the 2024-T861 alloy than in the 2124-T851 alloy. This effect is quite likely related to the higher toughness of the 2124-T851 alloy, caused by the combined effect higher purity and different thermo-mechanical processing.

Effect of Panel Constraint. At the 144°K (-200°F) or the 294°K (70°F) test temperatures, no significant difference between the stiffened and unstiffened flaw growth rate curves is apparent for any test direction/thickness combination. These observations agree well with those of Section 3.4, which found that flaw lengths were generally too small to cause significant buckling at these temperatures.

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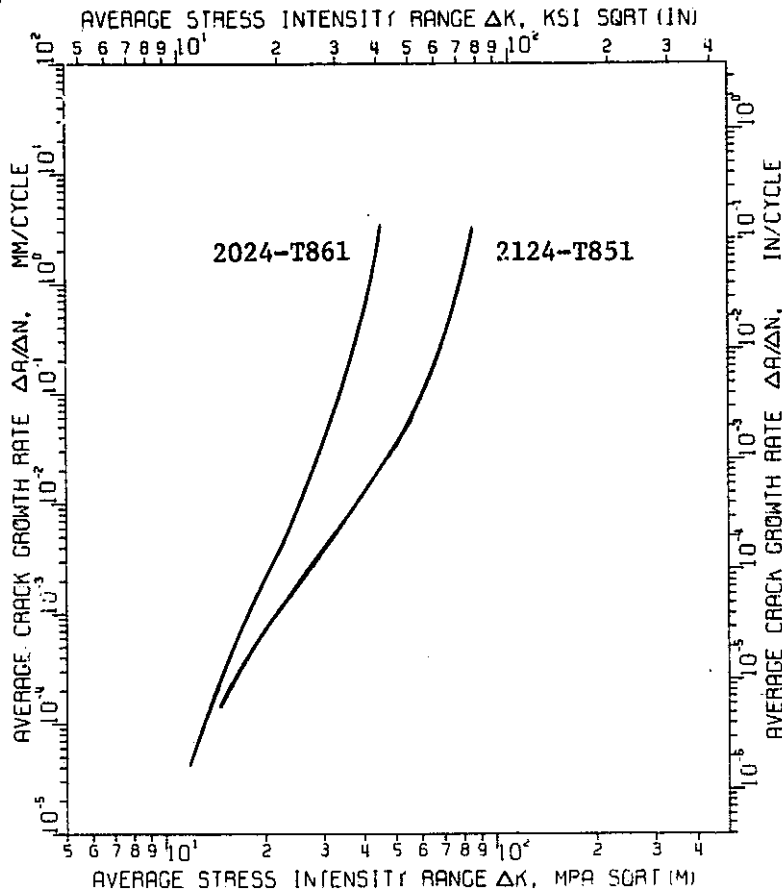


FIGURE 4-2

EFFECT OF ALLOY COMPOSITION/HEAT TREATMENT ON ROOM TEMPERATURE FLAW GROWTH RATE
(curves are hand-faired from Appendix D, Figures D3-2a and D3-3a)

However, at elevated temperatures, a distinct layering effect can be observed for both the 1.60 mm (.063 inch) and the 3.18 mm (.125 inch) thicknesses, as shown in Figure 4-3. No conclusion could be reached in Section 3.4 as to the effect of panel buckling on fracture toughness at elevated temperatures, due to the lack of data caused by net section yielding. However, in view of the results of the elevated temperature cyclic tests, it is likely that buckling would also decrease toughness if a wide enough specimen were employed.

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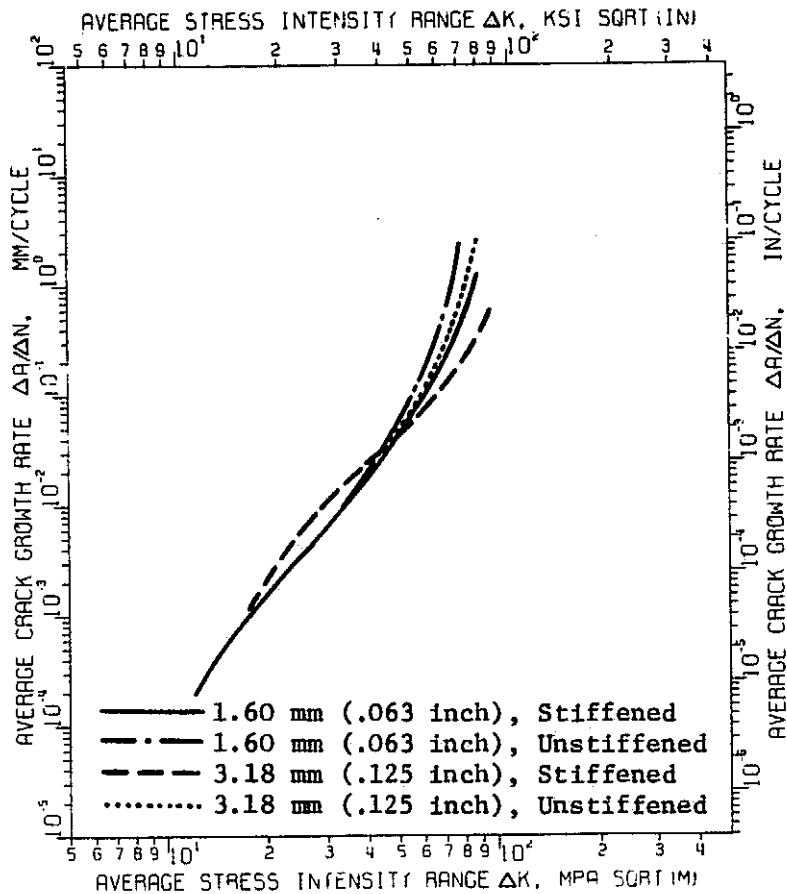


FIGURE 4-3

EFFECT OF STIFFENING ON THE 450°K (350°F) FLAW GROWTH RATE OF 2024-T861
(curves are hand-faired from Appendix D, Figures D1-7a, D1-9a, D2-7a, and D2-9a)

Effect of Test Direction. The effect of test direction relative to the rolling direction of the sheet or plate is shown in Figure 4-4. It can be observed that crack propagation is slightly faster for the transverse test direction than for the longitudinal direction. Similar layering effects are observed in the data obtained at other temperatures and for other thicknesses.

Effect of Specimen Thickness. As shown in Figure 4-5 for the 2024-T861 alloy tested at room temperature in argon at a stress ratio of 0.05, increasing section

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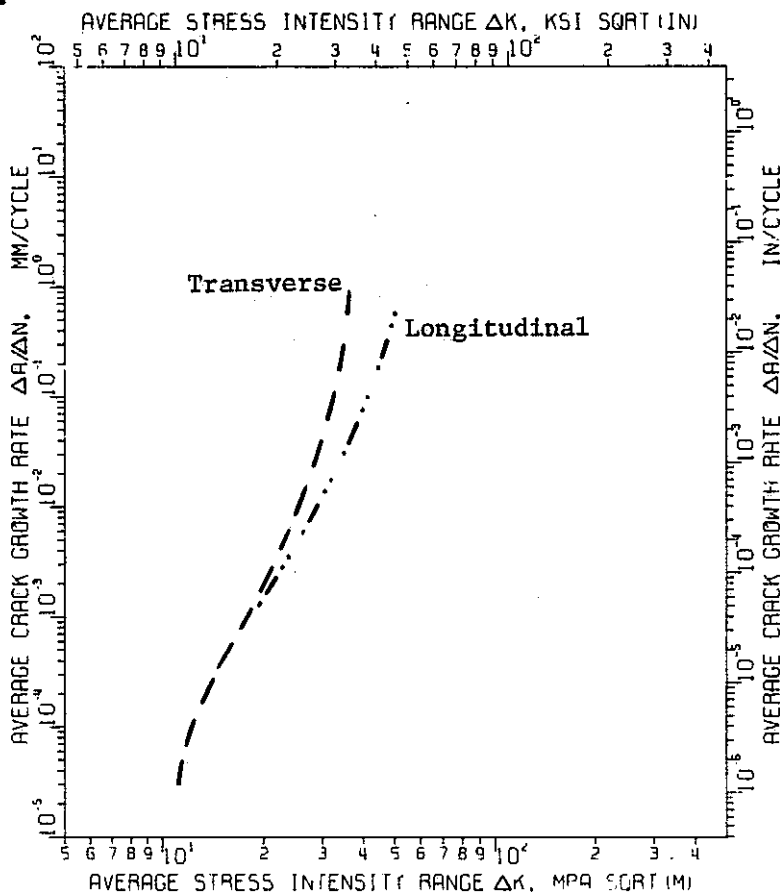


FIGURE 4-4

EFFECT OF TEST DIRECTION ON THE ROOM TEMPERATURE FLAW GROWTH RATE OF 2024-T861
(curves are hand-faired from Appendix D, Figure D2-4)

thickness tends to increase crack growth rate for equivalent stress intensity conditions. The layering observed in this figure is also evident for data at the higher stress ratio ($R=0.5$) and at lower temperatures (144°K or 200°F). The effect appears to be lost at elevated temperatures, primarily because net section yielding precluded the attainment of the high ΔK levels necessary to observe the effect.

Effect of Test Temperature/Environment. Test temperature was found to exert a strong influence on the flaw growth rate of 2124-T851, as shown in Figure 4-6;

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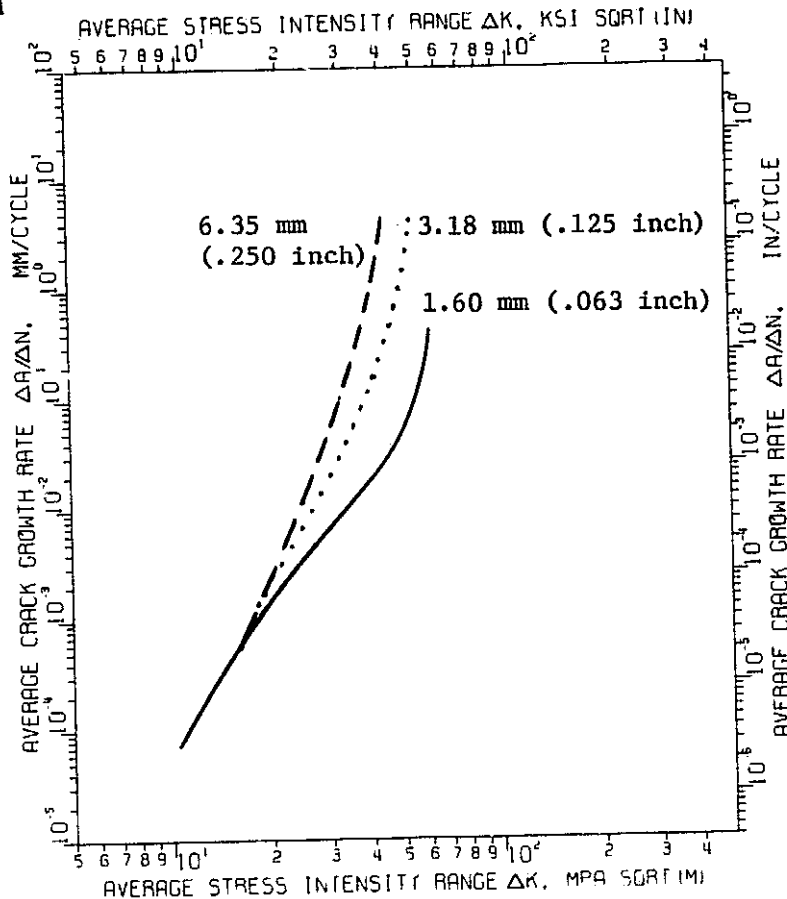


FIGURE 4-5

EFFECT OF THICKNESS ON THE ROOM TEMPERATURE FLAW GROWTH RATE OF 2024-T861
(curves are hand-faired from Appendix D, Figures D1-4a, D2-4a, and D3-2a)

similar effects were observed for the other alloy/thickness combinations investigated. Cryogenic temperatures were found to primarily affect the flaw growth rate in the high ΔK range preceding instability; in this region, the growth rate is accelerated relative to that at room temperature due to a decrease in the toughness of the material. Similarly, elevated temperatures promote an increase in material toughness and cause the flaw growth in the high ΔK range to decrease relative to that at room temperature. However, this trend is not observed as the temperature is increased

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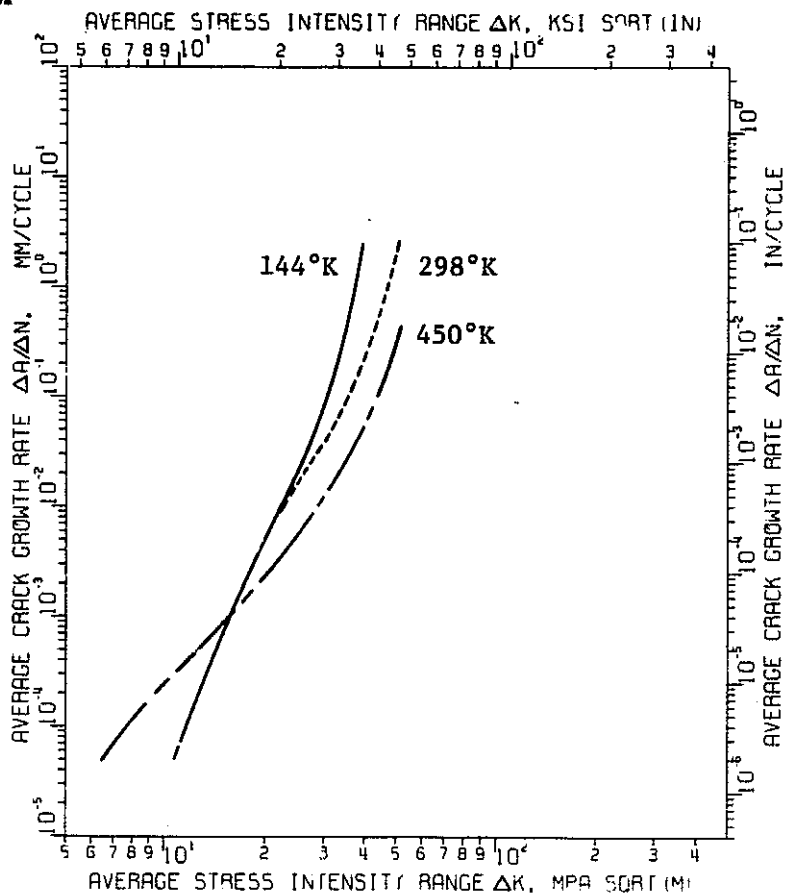


FIGURE 4-6

EFFECT OF TEST TEMPERATURE ON THE FLAW GROWTH RATE OF 2124-T851
(curves are hand-faired from Appendix D, Figures D6-2a, D6-4a, and D6-6a)

from 422°K (300°F) to 478°K (400°F), as an examination of the flaw growth rate curves in Appendix D will prove. Although there is a tendency for this high temperature data to have wider scatter bands than the lower temperature data, no consistent trend can be established.

At the opposite end of the flaw growth rate curve (i.e., the low ΔK range), elevated temperatures have an opposite effect on the threshold value, ΔK_0 ; that is, higher test temperatures appear to decrease ΔK_0 relative to the room temperature

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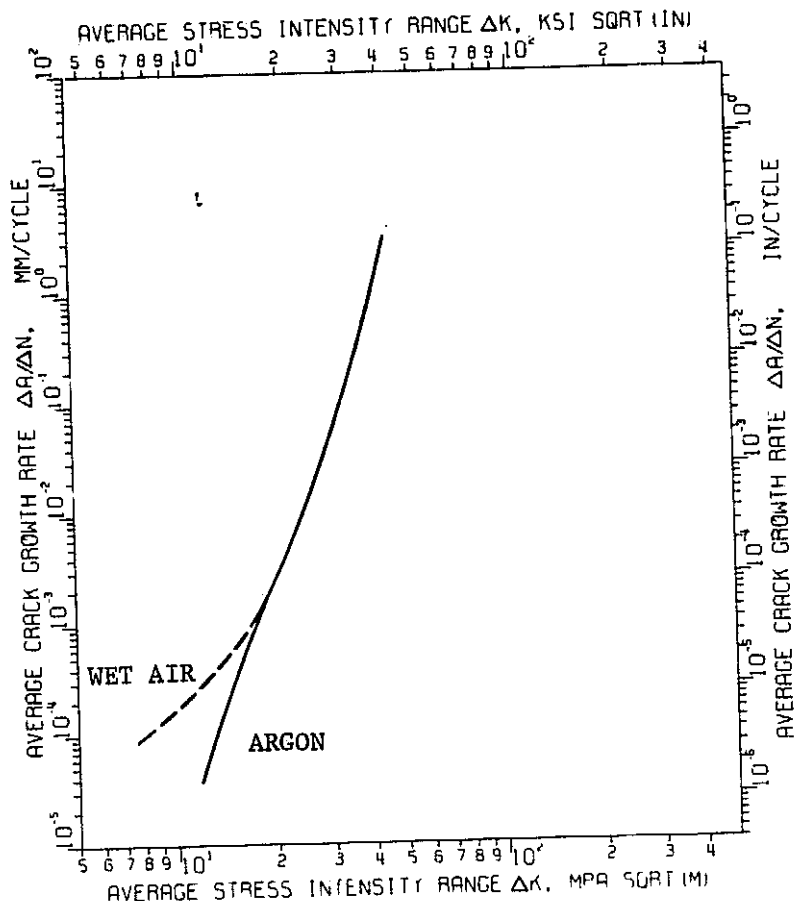


FIGURE 4-7

EFFECT OF RELATIVE HUMIDITY ON THE ROOM TEMPERATURE FLAW GROWTH RATE OF 2024-T861
(curves are hand-faired from Appendix D, Figure D3-2a)

value. The curves shown in Figure 4-6 appear to indicate that cryogenic temperatures have little affect on the threshold value; however, no firm conclusion can be drawn in this regard because of the lack of cryogenic data in this region of the curve.

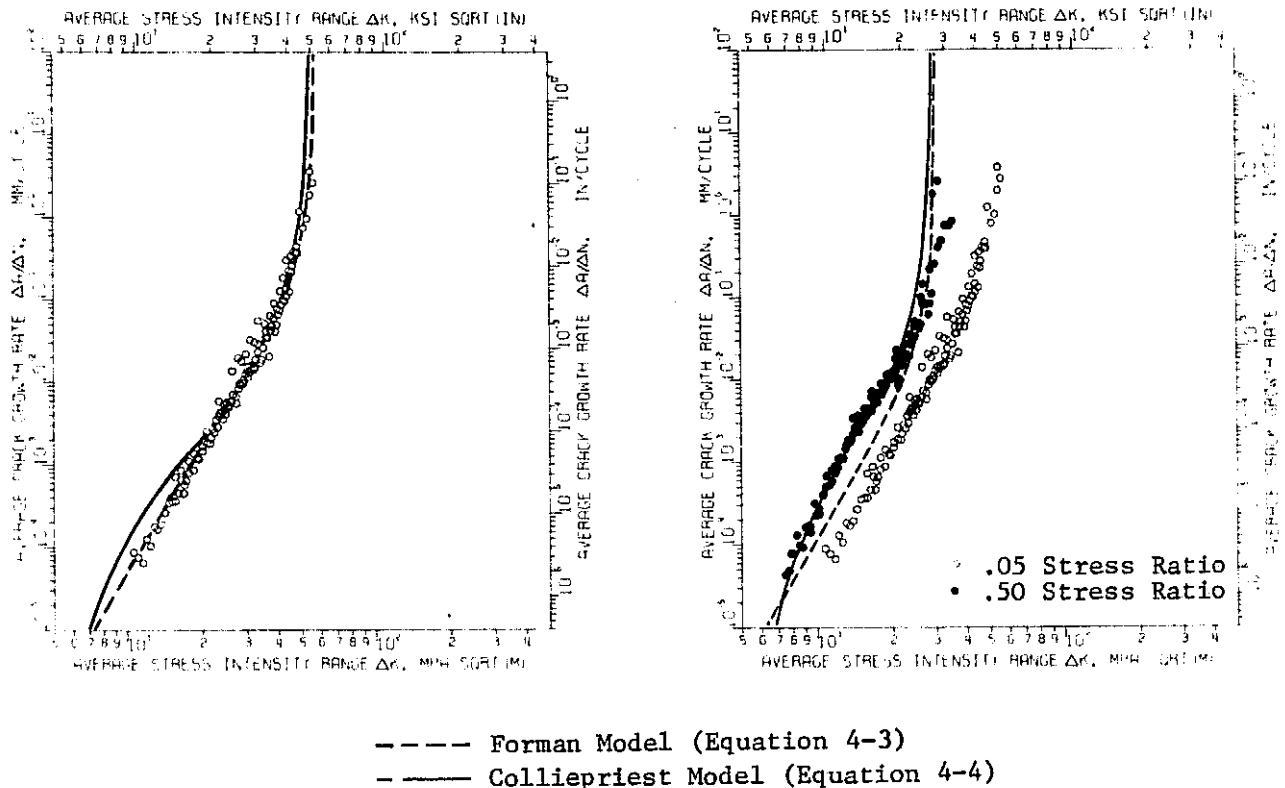
The value of ΔK_0 was also found to be affected by the relative humidity at room temperature. As shown in Figure 4-7 the wet air environment ($RH \approx 100\%$) causes the value of ΔK_0 to decrease relative to the dry argon environment ($RH = 0.03\%$).

Effect of Applied Stress Level. Examination of the flaw growth rate curves in Appendix D shows that flaw growth rate is unaffected by differences in the magnitude

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(a) Comparison of Test Data for $R = .05$ with Least Squares Fit of Various Rate Models

(b) Comparison of Test Data for $R = .50$ with Predicted Behavior from (a)

FIGURE 4-8

EFFECT OF STRESS RATIO ON THE ROOM TEMPERATURE FLAW GROWTH RATE OF 2024-T861
(curves are hand-faired from Appendix D, Figure D2-4a and D2-5a)

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of the maximum applied cyclic stress. Such results indicate that the stress intensity parameter adequately accounts for differences in stress level.

Effect of Cyclic Frequency. Cyclic test frequency was observed to have no effect on fatigue flaw growth rate. For corresponding tests, the 20 and 200 cpm cyclic data was found to be indistinguishable for all test conditions evaluated.

Effect of Stress Ratio. The effect of stress ratio (minimum to maximum cyclic stress) on flaw growth rate is shown in Figure 4-8. Because both the Forman and

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Table 4-4

PARAMETERS USED TO OBTAIN CURVES IN FIGURE 4-8

MODEL/PARAMETER	SI UNITS	ENGLISH UNITS
Forman (Equation 4-2)		
° K_C^+	60.1 MPa \sqrt{m}	54.7 ksi \sqrt{in}
° C^{**}	.6174 E-10*	.1734 E-8
° n	4.582	4.582
Colliepriest (Equation 4-4)		
° ΔK_O^{++}	5.7 MPa \sqrt{m}	5.2 ksi \sqrt{in}
° K_C	60.1 MPa \sqrt{m}	54.7 ksi \sqrt{in}
° C_1	.1264 E-5 m/cycle	.4974 E-8 inch/cycle
° C_2	4.394	4.394
° $C(P)^{***}$.2360 E-10	.1321 E-8
° $n(P)$	3.731	3.731

* E-10 = 10^{-10} , E-8 = 10^{-8} , etc.

** SI Units: $\frac{m/cycle}{(MPa \sqrt{m})^{n-1}}$; English Units: $\frac{in/cycle}{(ksi \sqrt{in})^{n-1}}$

*** SI Units: $\frac{m/cycle}{(ksi \sqrt{in})^n}$; English Units: $\frac{in/cycle}{(ksi \sqrt{in})^n}$

+ From Appendix C, Table C3-1

++ From Appendix E, Table E2-2

Colliepriest rate models (equations 4-3 and 4-4, respectively) attempt to account for the effect of stress ratio, an attempt was made to predict the behavior at one stress ratio from an analysis of the data at the other stress ratio. The linearized form of each model (i.e., equations 4-9 and 4-10) was fit to the 0.05 stress ratio data shown in Figure 4-8(a) in a least squares manner. The K_C and ΔK_O values used in this analysis were obtained from fracture toughness testing and from regression/convergence analysis, respectively. The rate parameters obtained from this analysis are listed in Table 4-4; they were used to generate the curves shown in Figure 4-8(j). As can be seen, slightly better agreement is obtained between

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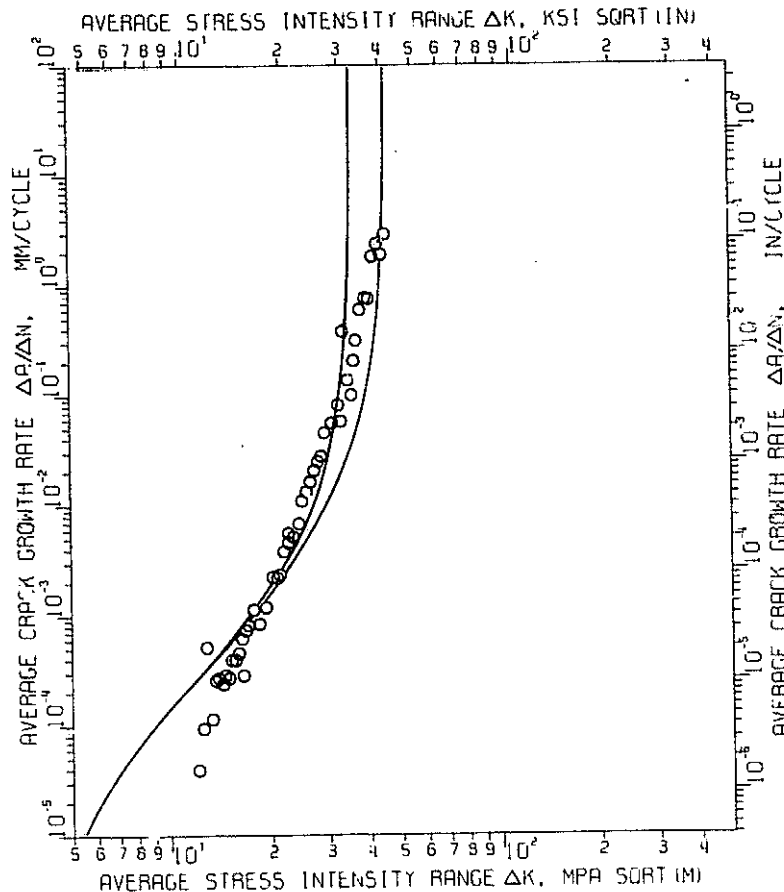


FIGURE 4-9

COMPARISON OF 2024-T861 DATA WITH REFERENCE 4-7 DATA
(Data from Appendix D, Figure D5-2a)

the test data and the curve predicted by the Colliepriest model.

4.3.2 Comparison of Cyclic Data Bases

The cyclic test data generated under this program was compared with that obtained by other investigators for these alloys. The growth rate curves obtained from room temperature tests of 2024-T861 and 2124-T851 compact tension specimens having respective thicknesses 6.38 mm (.250 inch) and 12.7 mm (.500 inch) are shown in Figures 4-9 and 4-10. These curves were generated using the flaw growth rate

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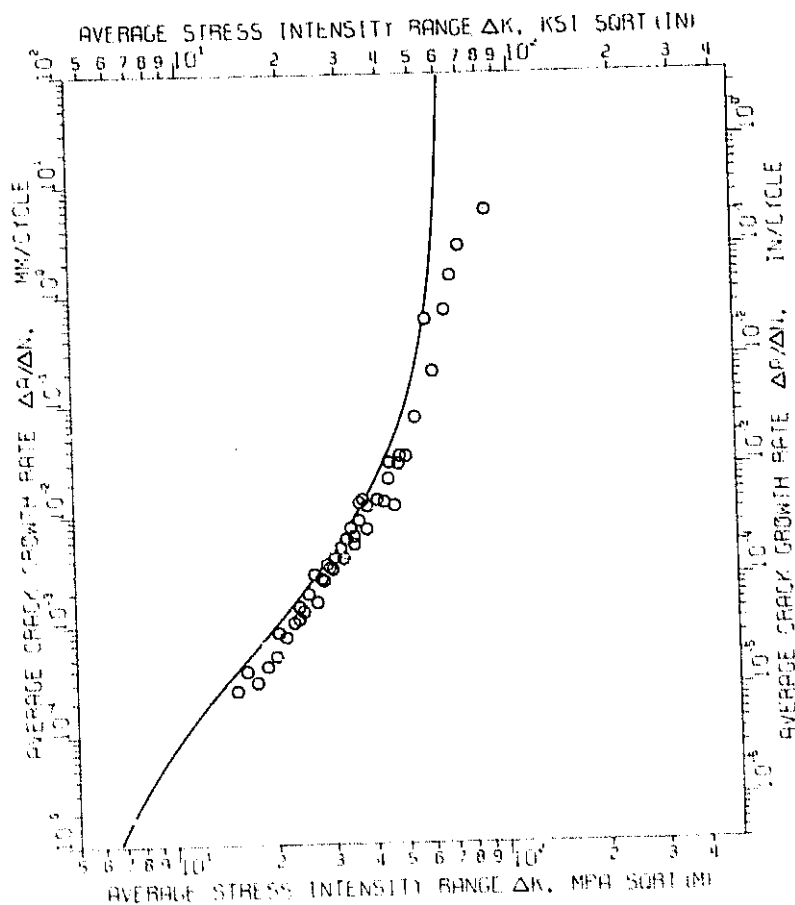


FIGURE 4-10

COMPARISON OF 2124-T851 DATA WITH REFERENCE 4-7 DATA
(Data from Appendix D, Figure D7-2a)

parameters specified in Reference 4-7 and a stress ratio of 0.05. Also shown in these figures is the room temperature cyclic data obtained under this program. The agreement between the two data bases appears to be excellent.

4.3.3 Comparison of Rate Models with Test Data

As discussed in Section 4.2.2, regression/convergence techniques were used to fit the Forman and Colliepriest fatigue flaw growth rate models (Equations 4-3 and

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4-4) to the cyclic test data generated under this program; the results of these analyses are collected in Appendix E. These techniques permitted the value of K_C to be optimized for each data set examined; as shown in Tables 4-5 and 4-6, a consistent discrepancy exists between these optimized K_C values obtained by curve fitting and those derived from static tensile testing. As shown in Figure 4-11, these "curve fit" K_C values are consistently higher than the corresponding "static" values. These results also indicate that, for any given test condition, the optimized K_C value obtained using the Colliepriest rate model is in most cases always higher than that obtained using the Forman rate model.

The differences between the two optimized K_C values are most likely related to the nature of the mathematical model used to fit the data. However, the differences between these and the static values are related to the nature of the curve fitting process and not to any difference in the response of the material to the manner in which load is applied. That the K_C value is unique is confirmed by the maximum stress intensity values shown in Tables 4-5 and 4-6. This data, also plotted in Figure 4-11, was obtained from those tests for which crack length was measured on the cycle before failure and represents the stress intensity at maximum load. These values confirm that the critical stress intensity parameter, K_C , is essentially independent of loading profile.

The discrepancy between the static and the curve fit K_C values must be related to the nature of the curve fitting process because an unusually large variation in standard deviation (.012 to .469) is associated with the optimized values. Such a wide variation in standard deviation could be related to the fairly large scatter bands associated with some data sets or the fact that the rate models fit some data sets better than others. More significantly, however, is the fact that the amount of data at the high ΔK levels (i.e., immediately preceding instability) is limited and varies from one data set to another. The accuracy with which the curve

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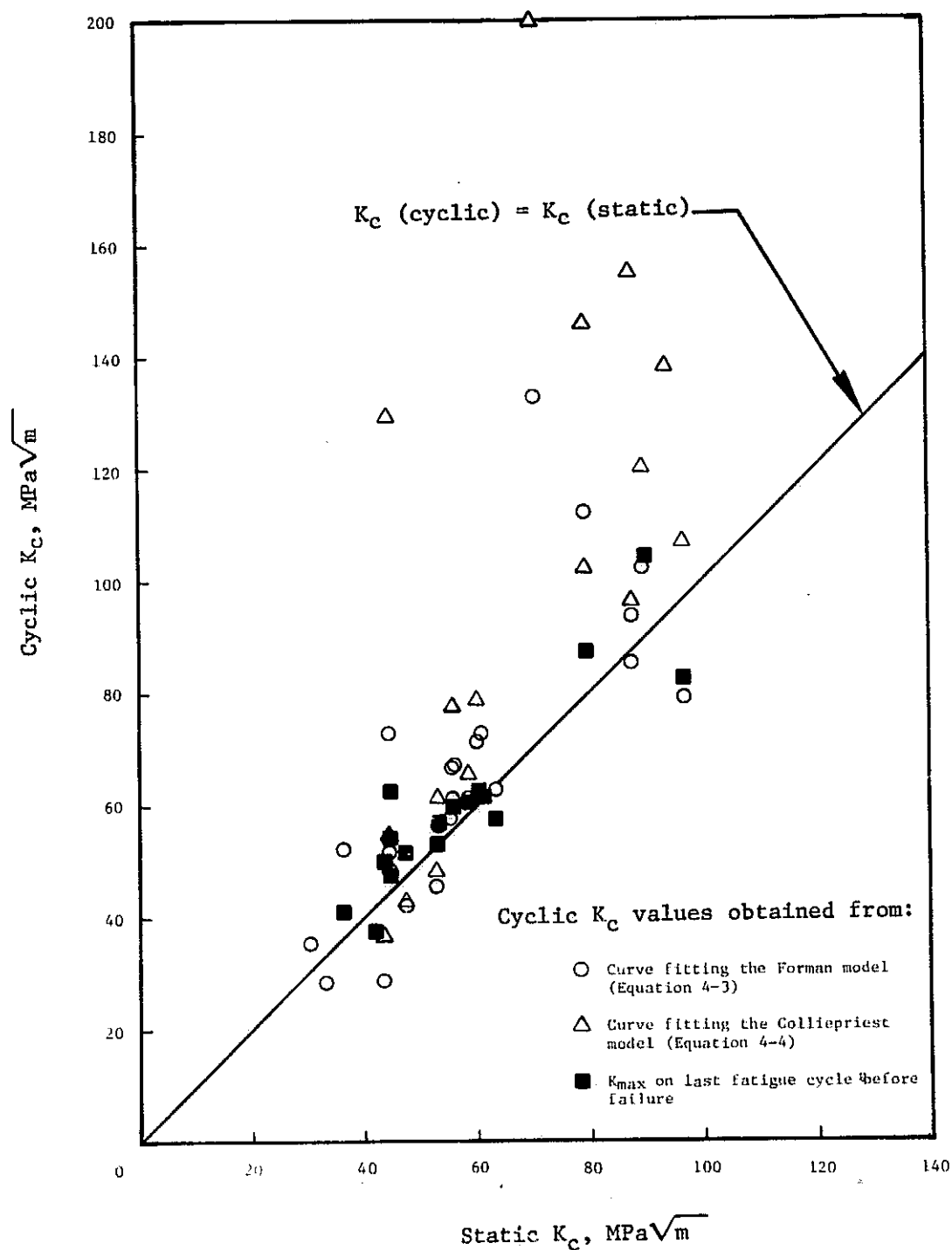


FIGURE 4-11

STATIC VS CYCLIC K_c VALUES FOR 2024-T861 AND 2124-T851

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Table 4-5

STATIC AND CYCLIC FRACTURE TOUGHNESS (K_{IC}) FOR 2024-T861

NOMINAL THICKNESS in	CONSTRAINT**	TEMPERATURE (°K)	TEST DIRECTION	AVERAGE K_{IC} (STATIC)*		AVERAGE K_{max} @ N-1**		K_{IC} (CURVE FIT)***			
				MPa√in	ksi√in	MPa√in	ksi√in	FORMAN		COLLIERPRIEST	
								MPa√in	ksi√in	MPa√in	ksi√in
1.60	.063	144	L	58.4	51.2	60.8	55.3	61.2	55.7	65.6	59.7
			T	47.2	43.0	51.6	47.0	42.9	39.9	42.8	38.9
		294	L	60.9	55.4	61.4	56.3	72.8 (A)	66.3 (A)	79.2 (A)	72.1 (A)
			T	52.8	48.0	53.0	48.3	45.4 (A)	41.3 (A)	48.0 (A)	43.7 (A)
		450	L	NSY	--	--	--	107.7	98.0	110.1	100.2
			T	NSY	--	--	--	74.0	68.0	76.5	69.6
1.60	.063	144	L	60.6	55.2	--	--	FC	FC	FC	FC
			T	--	--	--	--	55.1	50.1	FC	FC
		294	L	66.7	60.7	--	--	76.7 (A)	69.8 (A)	85.3 (A)	77.6 (A)
			T	51.1	46.5	--	--	67.5 (W)	61.4 (W)	FC (W)	FC (W)
		450	L	97.9	89.1	--	--	53.0 (A)	48.2 (A)	59.3 (A)	54.0 (A)
			T	--	--	--	--	50.1 (W)	45.6 (W)	FC (W)	FC (W)
3.18	.125	144	L	53.0	48.2	56.7	51.6	56.4	51.3	61.2	55.7
			T	37.3	34.0	42.1	38.4	FC	FC	FC	FC
		294	L	60.1	54.7	62.2	56.7	71.7 (A)	65.3 (A)	78.9 (A)	71.8 (A)
			T	44.6	40.7	47.4	43.1	48.3 (A)	44.0 (A)	54.5 (A)	49.6 (A)
		450	L	NSY	--	--	--	129.1	117.5	FC	FC
			T	NSY	--	--	--	102.0	92.8	FC	FC
3.18	.125	144	L	61.2	56.0	--	--	58.4	53.2	70.9	64.5
			T	--	--	--	--	FC	FC	39.6	36.0
		294	L	73.0	66.4	--	--	FC (A)	FC (A)	78.9 (A)	71.8 (A)
			T	47.4	43.1	--	--	66.0 (W)	60.0 (W)	82.9 (W)	75.4 (W)
		450	L	--	--	--	--	52.1 (A)	47.4 (A)	FC (A)	FC (A)
			T	34.6	38.8	--	--	37.4 (W)	34.1 (W)	FC (W)	FC (W)
6.35	.250	144	L	36.5	33.2	41.0	37.3	52.2	47.5	FC	FC
			T	30.4	27.7	--	--	35.3	32.1	FC	FC
		294	L	43.7	39.8	49.9	45.4	FC (A)	FC (A)	FC (A)	FC (A)
			T	33.7	30.7	--	--	28.5 (W)	25.9 (W)	36.9 (W)	33.6 (W)
		450	L	93.8	85.3	--	--	FC (A,20)	FC (A,20)	FC (A,20)	FC (A,20)
			T	70.6	64.0	--	--	28.1 (A)	25.6 (A)	FC (A)	FC (A)

* All dynamic K_{IC} values are for 200 CPM tests unless noted by (20), indicating 20 CPM tests. Other abbreviations are:

A = Argon Environment
W = Wet Air Environment
NSY = Net Section Yielding
FC = Failure to Converge

** Stiffened: Buckling restrained
Unstiffened: Buckling unrestrained

* Static K_{IC} determined from fracture toughness testing (Appendix C).

** K_{max} @ N-1: Average K_{max} values on last fatigue cycle before failure (from Appendix D).

*** Curve Fit: K_{IC} determined from curve fitting rate models to data representing both 0.05 and 0.50 stress ratios, using regression/convergence techniques (Appendix E); "Forman" K_{IC} values represent those obtained using the Forman rate model (Equation 4-8); "Collierpriest" K_{IC} values represent those obtained using the Collierpriest rate model (Equation 4-4).

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Table 4-6

STATIC AND CYCLIC FRACTURE TOUGHNESS (K_{IC}) FOR 2124-T851

NOMINAL THICKNESS mm in	TEMPERATURE °K	TEST DIRECTION	AVERAGE K_{IC} (STATIC)* MPa√m ksi√in		AVERAGE K_{max} @ N-1** MPa√m ksi√in		K_{IC} (CURVE FIT)			
							FORMAN		COLLIEPRIEST	
							MPa√m	ksi√in	MPa√m	ksi√in
6.35 .250	144	L	89.3	81.3	104.3	94.9	102.2	93.0	120.1	109.3
		T	63.1	58.0	57.5	52.3	62.9	57.2		FC
	294	L	87.3	79.5	--	--	93.7 (A)	85.3 (A)	155.2 (A)	141.2 (A)
							85.2 (W)	77.5 (W)	96.1 (W)	87.4 (W)
		T	55.5	50.5	59.7	54.3	57.5 (A,20)	52.3 (A,20)		FC (A,20)
							66.8 (A,200)	60.8 (A,200)	77.7 (A,200)	70.7 (A,200)
							61.0 (W,20)	55.5 (W,20)		FC (A,W)
							67.0 (W,200)	60.9 (W,200)		FC (W,200)
	450	L	NSY	--	--	--	125.6	114.3	100.6	9.15
		T	NSY	--	--	--	99.3 (20)	90.3 (20)	201.6 (20)	183.5 (20)
							141.7	129.0	114.9	104.5
11.45 .450	144	L	96.5	87.8	82.6	75.2	78.9	71.8	107.4	97.8
			44.5	40.5	62.5	56.9	51.3	46.7		FC
	294	L	79.1	72.0	87.4	79.6	112.2 (A)	102.1 (A)	145.9 (A)	132.8 (A)
								FC (W)	102.2 (W)	93.0 (W)
		T	44.5	40.5	54.2	49.4	72.8 (A)	66.3 (A)	129.5 (W)	117.9 (W)
	450	L	NSY	--	--	--	102.7	93.5	109.2	99.4
		T	NSY	--	--	--	98.5	89.3		FC

* All dynamic K_{IC} values are for 200 CPM tests unless noted by (20), indicating 20 CPM tests. Other abbreviations are:

A = Argon Environment
W = Wet Air Environment
NSY = Net Section Yielding
FC = Failure to Converge

* Static: As determined from fracture toughness testing (Appendix C).

** K_{max} @ N-1: Average K_{max} values on last fatigue cycle before failure (from Appendix D).

*** Curve Fit: As determined from curve fitting rate models to data representing both 0.05 and 0.50 stress ratios, using regression/convergence techniques (Appendix E); "Forman" K_{IC} values represent those obtained using the Forman rate model (Equation 4-8); "Colliepriest" K_{IC} values represent those obtained using the Colliepriest rate model (Equation 4-4).

fitting process selects a value for K_{IC} , then, can only be as good as the amount of cyclic data in the immediate vicinity of instability.

The results of the regression/convergence analyses also indicate that, even when the difference between the static and optimized K_{IC} values are small, no one rate model is superior in its agreement with the experimental data above flaw growth rates of 10^{-4} mm/cycle (3.9×10^{-6} inch/cycle). For crack growth rates less than this value, the behavior predicted by the two models differs significantly;

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unfortunately, the test data generated in this range was limited. However, visual examination of the results of the curve fitting process showed that a slightly better fit was obtained for the sigmodal curves associated with the Colliepriest model.

4.4 REFERENCES

- 4-1 R. G. Forman, V. E. Kearney, R. M. Engle; "Numerical Analysis of Crack Propagation in Cyclic-Loaded Structures," Journal of Basic Engineering, Vol. 89, 1967, pp. 459-464.
- 4-2 J. E. Colliepriest, Jr., R. M. Ehret, "A Generalized Relationship of Fatigue Crack Growth Rates", Space Division, Rockwell International Corporation, SD 74-CE-0001, March, 1974.
- 4-3 P. C. Paris, "The Growth of Cracks Due to Variations in Loads", PhD Thesis, Lehigh University, 1962.
- 4-4 J. E. Colliepriest, Jr., and R. M. Ehret, "Computer Modeling of Part-Through-Crack Growth", Space Division, Rockwell International Corporation, SD 72-CE-0015, 1972.
- 4-5 A. Ralston, A First Course in Numerical Analysis, pp. 323-328.
- 4-6 F. B. Hildebrand, Introduction to Numerical Analysis, pp. 443-445.

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5.0 CONCLUSIONS

5.1 FRACTURE TOUGHNESS PROPERTIES

The following conclusions can be drawn from the fracture toughness data generated during this study:

- 1) for equivalent section thicknesses, the K_{IC} values for the 2124-T851 alloy are almost twice those of the 2024-T861 alloy;
- 2) for section thicknesses as thin as 1.60 mm (.063 inch), buckling has little effect on the fracture behavior of 2024-T861;
- 3) for all test conditions, the fracture toughness (K_{IC}) in the transverse test direction is approximately 15-20 percent lower than the corresponding longitudinal value;
- 4) for both alloys, fracture toughness decreases with increasing section thickness, particularly in the thinner gages of the 2024-T861 alloy;
- 5) for both alloys, increasing temperature causes an increase in fracture toughness; for the 2024-T861 alloy with a thickness of 6.35 mm (.250 inch), toughness increases 250 percent over the temperature range 144°K to 450°K (-200°F to 350°F);
- 6) no systematic variation of fracture toughness with initial flaw size was observed for any test condition investigated.

5.2 FATIGUE CRACK GROWTH PROPERTIES

The conclusions drawn from the fatigue crack growth data are:

- 1) for equivalent section thicknesses and stress intensity conditions, the crack growth rate for the 2024-T861 alloy is faster than that for the 2124-T851 alloy;

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- 2) for section thicknesses in the range 1.60 - 3.18 mm (.063 - .125 inch), buckling accelerates the crack growth process only at elevated temperature (450°K or 350°F);
- 3) for equivalent stress intensity conditions, the crack growth rate is higher for the transverse test direction than for the longitudinal test direction;
- 4) for equivalent stress intensity conditions, the crack growth rate of both alloys increases with increasing section thickness;
- 5) for equivalent test conditions, increasing test temperature causes an increase in flaw growth rate at low ΔK levels and a decrease in flaw growth rate at high ΔK levels.
- 6) for the test conditions investigated, differences in applied stress level and cyclic frequency have no effect on flaw growth rate;
- 7) for equivalent test conditions, crack growth rate increases with decreasing stress ratio, and the effect is adequately predicted by the Forman and Colliepriest empirical rate models;
- 8) differences in K_{IC} between that derived from toughness testing and that obtained from cyclic testing using least squares/convergence techniques are due primarily to the lack of sufficient cyclic data near the point of instability and not to any fundamental difference in the response of the material to the way in which load is applied;
- 9) based on limited flaw growth rate data below 10^{-4} mm/cycle, it appears that slightly better fit between predicted behavior and actual data was obtained for the Colliepriest rate model.

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6.0. RECOMMENDATIONS

As a result of the work conducted under this program, one area has been observed that requires further investigation. It has been realized that a critical need exists for a statistically significant technique for the reduction and analysis of fatigue flaw growth data. Such a study should include at least the following:

- o an examination of the possibility of using spline functions with a least squares procedure to establish the relation between crack length and number of applied fatigue cycles;
- o developing a practical method for solving the integrated form of the various rate models in order that the fatigue flaw growth parameters may be evaluated directly from the measured crack length/cycle data;
- o determining if a statistically significant difference exists in the cyclic life predicted by the various rate models;
- o determining the best numerical algorithm for computing the constants associated with each flaw growth rate model.

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Appendix A TENSILE TEST DATA

The following data tables incorporate the mechanical property values obtained from tensile tests of 2024-T861 sheet and 2124-T851 plate specimens. Table A-1 summarizes the design mechanical properties for these alloys, based on the data presented in Reference 4-7. Tables A-2 through A-4 include the data obtained from 2024-T861 sheet specimens, while Tables A-5 through A-7 include the data obtained from the 2124-T851 plate specimens. The elastic modulus values reported represent those obtained from the slope of the stress-strain curve, generated using a Class B-1 extensometer.

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TABLE A-1

ROOM TEMPERATURE DESIGN MECHANICAL PROPERTIES FOR BARE 2024-T861 AND 2124-T851 ALUMINUM*

		2024-T861**		2124-T851***	
		L ORIENTATION	T ORIENTATION	L ORIENTATION	T ORIENTATION
F _{tu}	MPa	496.4	489.5	448	448
	ksi	72	71	65	65
F _{ty}	MPa	462.0	455	393	393
	ksi	67	66	57	57
E	10 ³ MPa	72.40	72.40	71.71	71.71
	10 ⁶ psi	10.7	10.7	10.4	10.4
ELONGATION, PER CENT		4	4	6	4

*FROM: MATERIALS PROPERTIES MANUAL, VOLUME I, DESIGN DATA; SPACE DIVISION, ROCKWELL INTERNATIONAL; JUNE, 1974.

**VALUES FOR SHEET 1.60 - 6.32 mm (.063-.249 inch) THICK.

***VALUES FOR PLATE 50.8 - 76.2 mm (2.001-3.000 inch) THICK.

TABLE A-2. MECHANICAL PROPERTIES OF AS-RECEIVED 2024-T861 ALUMINUM ALLOY SHEET AT 144°K (-200°F)

SHEET THICKNESS		SHEET NO.	SPECIMEN NO.	TEST DIRECTION	F _{ty}		F _{tu}		Modulus		Elongation, % (5.08cm gage length)
mm	in				MPa	ksi	MPa	ksi	10 ³ MPa	10 ⁶ psi	
1.60	.063	4	63-4LS-1	L	551.6	80.0	582.6	84.5	88.74	12.9	6
1.60	.063	5	63-5LS-1	L	548.2	79.5	582.6	84.5	73.91	10.7	6
1.60	.063	6	63-6LS-1	L	548.2	79.5	579.2	84.0	81.98	11.9	6
AVG:					549.3	79.7	581.5	84.3	81.54	11.8	6
1.60	.063	1	63-1TS-2	T	548.2	79.5	586.1	85.0	76.26	11.1	6
1.60	.063	1	63-1TS-3	T	*	*	582.6	84.5	*	*	6
1.60	.063	4	63-4TS-1	T	537.8	78.0	579.2	84.0	78.19	11.3	6
AVG:					543.0	78.8	582.6	84.5	77.22	11.2	6
3.18	.125	1	125-1LS-1	L	548.2	79.5	589.5	85.5	75.43	10.9	7
3.18	.125	4	125-4LS-1	L	561.9	81.5	599.9	87.0	77.64	11.3	7
3.18	.125	5	125-5LS-1	L	572.3	83.0	603.3	87.5	82.53	12.0	7
AVG:					560.8	81.3	597.6	86.7	78.53	11.4	7
3.18	.125	1	125-1TS-3	T	561.9	81.5	596.4	86.5	74.26	10.8	6
3.18	.125	2	125-2TS-2	T	572.3	83.0	596.4	86.5	74.19	10.6	6
3.18	.125	4	125-4TS-1	T	555.0	80.5	596.4	86.5	76.47	11.1	6
AVG:					563.1	81.7	596.4	86.5	74.97	10.9	6
6.35	.250	2	250-2LS-1	L	*	*	575.7	83.5	*	*	7
6.35	.250	3	250-3LS-1	L	*	*	589.5	85.5	*	*	7
6.35	.250	3	250-3LS-2	L	579.2	84.0	593.0	86.0	83.29	12.1	6
AVG:					579.2	84.0	586.1	85.0	83.29	12.1	7
6.35	.250	2	250-2TS-1	T	*	*	568.8	82.5	*	*	6
6.35	.250	2	250-2TS-2	T	534.4	77.5	568.8	82.5	76.95	11.2	6
6.35	.250	3	250-3TS-1	T	558.5	81.0	586.1	85.0	80.81	11.7	6
AVG:					546.5	79.3	574.6	83.3	78.88	11.4	6

* Extensometer slipped off specimen.

TABLE A-3. ROOM TEMPERATURE MECHANICAL PROPERTIES OF AS-RECEIVED 2024-T861 ALUMINUM ALLOY SHEET

SHEET THICKNESS		SHEET NO.	SPECIMEN NO.	TEST DIRECTION	F _{ty}		F _{tu}		MODULUS		ELONGATION, % (5.08 cm GAGE LENGTH)
mm	in				MPa	ksi	MPa	ksi	10 ³ MPa	10 ⁶ psi	
1.60	.063	1	63-ILS-1	L	499.9	72.5	520.6	75.5	70.33	10.2	6.5
1.60	.063	1	63-ILS-2	L	496.4	72.0	517.1	75.0	71.02	10.3	6.5
1.60	.063	1	63-ILS-3	L	496.4	72.0	517.1	75.0	69.64	10.1	6.0
AVG:					497.8	72.2	518.5	75.2	70.33	10.2	6.3
1.60	.063	1	63-ITS-1	T	493.0	71.5	520.6	75.5	69.64	10.1	5.5
1.60	.063	1	63-ITS-2	T	493.0	71.5	524.0	76.0	72.40	10.5	6.5
1.60	.063	6	63-6TS-1	T	496.4	72.0	524.0	76.0	73.09	10.6	7.0
AVG:					484.4	71.7	522.6	75.8	71.71	10.4	6.3
3.18	.125	1	125-ILS-2	L	496.4	72.0	520.6	75.5	71.02	10.3	7.5
3.18	.125	1	125-ILS-3	L	496.4	72.0	524.0	76.0	71.71	10.4	8.0
3.18	.125	2	125-2LS-1	L	499.9	72.5	524.0	76.0	71.02	10.3	8.0
AVG:					496.4	72.0	522.6	75.8	71.02	10.3	7.8
3.18	.125	1	125-ITS-2	T	496.4	72.0	524.0	76.0	67.57	9.8	7.0
3.18	.125	1	125-ITS-4	T	496.4	72.0	527.5	76.5	70.33	10.2	8.0
3.18	.125	6	125-6TS-1	T	503.3	73.0	534.4	77.5	71.71	10.4	7.5
AVG:					498.5	72.3	528.8	76.7	69.64	10.1	7.5
6.35	.250	1	250-ILS-1	L	510.2	74.0	517.1	75.0	68.26	9.9	6.5
6.35	.250	1	250-ILS-2	L	510.2	74.0	517.1	75.0	71.02	10.3	6.5
6.35	.250	1	250-ILS-3	L	510.2	74.0	517.1	75.0	70.33	10.2	7.0
AVG:					510.2	74.0	517.1	75.0	69.64	10.1	6.8
6.35	.250	1	250-ITS-1	T	496.4	72.0	510.2	74.0	71.71	10.4	6.0
6.35	.250	1	250-ITS-2	T	496.4	72.0	513.7	74.5	74.47	10.8	6.0
6.35	.250	3	250-3TS-3	T	506.8	73.5	527.5	76.5	71.02	10.3	7.0
AVG:					497.8	72.2	517.1	75.0	72.40	10.5	6.3

A-4

TABLE A-4. MECHANICAL PROPERTIES OF AS-RECEIVED 2024-T861 ALUMINUM ALLOY SHEET AT 450°K (350°F)

SHEET THICKNESS		SHEET NO.	SPECIMEN NO.	TEST DIRECTION	F _{ty}		F _{tu}		MODULUS		ELONGATION, % (5.08 cm GAGE LENGTH)
mm	in				MPa	ksi	MPa	ksi	10 ³ MPa	10 ⁶ psi	
1.60	.063	2	63-2LS-2	L	386.1	56.0	396.5	57.5	60.74	8.81	13
1.60	.063	3	63-3LS-1	L	386.1	56.0	389.6	56.5	56.81	8.24	12
1.60	.063	5	63-5LS-2	L	<u>382.7</u>	<u>55.5</u>	<u>389.6</u>	<u>56.5</u>	<u>59.92</u>	<u>8.69</u>	<u>10</u>
				AVG:	385.0	55.8	391.9	56.8	59.16	8.58	12
1.60	.063	2	63-2TS-1	T	396.5	57.5	403.4	58.5	62.74	9.10	13
1.60	.063	2	63-2TS-2	T	389.6	56.5	399.9	58.0	64.88	9.41	12
1.60	.063	3	63-3TS-1	T	<u>393.0</u>	<u>57.0</u>	<u>403.4</u>	<u>58.5</u>	<u>66.19</u>	<u>9.60</u>	<u>12</u>
				AVG:	393.0	57.0	402.2	58.3	64.61	9.37	12
3.18	.125	2	125-2LS-2	L	386.1	56.0	396.5	57.5	57.37	8.32	13
3.18	.125	2	125-2LS-1	L	*	*	393.0	57.0	59.84	8.68	12
3.18	.125	5	125-5LS-2	L	<u>396.5</u>	<u>57.5</u>	<u>403.4</u>	<u>58.5</u>	<u>58.33</u>	<u>8.46</u>	*
				AVG:	391.3	56.8	397.6	57.7	58.54	8.49	12
3.18	.125	1	125-1TS-1	T	396.5	57.5	403.4	58.5	57.23	8.30	12
3.18	.125	2	125-2TS-1	T	399.9	58.0	406.8	59.0	60.12	8.72	13
3.18	.125	3	125-3TS-1	T	<u>393.0</u>	<u>57.0</u>	<u>399.9</u>	<u>58.0</u>	<u>60.95</u>	<u>8.84</u>	<u>12</u>
				AVG:	396.5	57.5	403.4	58.5	59.43	8.62	12
6.35	.250	2	250-2LS-2	L	393.0	57.0	403.4	58.5	60.47	8.77	12
6.35	.250	4	250-4LS-1	L	382.7	55.5	393.0	57.0	60.40	8.76	12
6.35	.250	4	250-4LS-2	L	<u>382.7</u>	<u>55.5</u>	<u>393.0</u>	<u>57.0</u>	<u>58.68</u>	<u>8.51</u>	<u>12</u>
				AVG:	386.1	56.0	396.5	57.5	59.85	8.68	12
6.35	.250	1	250-1TS-3	T	396.5	57.5	406.8	59.0	57.78	8.38	12
6.35	.250	3	250-3TS-2	T	393.0	57.0	410.3	59.5	64.61	9.37	12
6.35	.250	3	250-3TS-3	T	<u>403.4</u>	<u>58.5</u>	<u>410.3</u>	<u>59.5</u>	<u>59.78</u>	<u>8.67</u>	<u>11</u>
				AVG:	397.8	57.7	409.1	59.3	60.74	8.81	12

* EXTENSOMETER SLIPPED OFF SPECIMEN.

TABLE A-5. MECHANICAL PROPERTIES OF AS-RECEIVED 2124-T851 ALUMINUM ALLOY PLATE AT 144°K (-200°F)

PLATE NO.	LOCATION*	SPECIMEN NO.	TEST DIRECTION	F _{ty}		F _{tu}		Modulus		Elongation, % (5.08cm gage length)
				MPa	ksi	MPa	ksi	10 ³ MPa	10 ⁶ psi	
2	Top	2L-1	L	534.4	77.5	565.4	82.0	81.64	11.8	8
2	Middle	2L-2	L	527.5	76.5	572.3	83.0	83.29	12.1	8
3	Top	3L-1	L	<u>541.3</u>	<u>78.5</u>	<u>575.7</u>	<u>83.5</u>	<u>81.84</u>	<u>11.9</u>	<u>8</u>
AVG:				534.4	77.5	571.1	82.8	82.26	11.9	8
1	Bottom	1TR-3	T	**	**	558.5	81.0	**	**	8
4	Top	4TR-1	T	506.8	73.5	555.0	80.5	81.98	11.9	7
5	Top	5TR-1	T	<u>506.8</u>	<u>73.5</u>	<u>555.0</u>	<u>80.5</u>	<u>79.43</u>	<u>11.5</u>	<u>8</u>
AVG:				506.8	73.5	556.2	80.7	80.71	11.7	8

* Location in a 5.08 cm (2.0 inch) thick plate.

** Extensometer slipped off specimen.

TABLE A-6. ROOM TEMPERATURE MECHANICAL PROPERTIES OF AS-RECEIVED 2124-T851 ALUMINUM ALLOY PLATE

PLATE NO.	LOCATION *	SPECIMEN NO.	TEST DIRECTION	F _{ty}		F _{tu}		Modulus		Elongation, % (5.08 cm gage length)
				MPa	ksi	MPa	ksi	10 ³ MPa	10 ⁶ psi	
1	Top	IL-1	L	486.1	70.5	510.2	74.0	72.40	10.5	10.0
1	Middle	IL-2	L	468.9	68.0	503.3	73.0	73.78	10.7	9.0
1	Bottom	IL-3	L	482.7	70.0	506.8	73.5	71.71	10.4	9.0
			AVG:	479.2	69.5	506.8	73.5	72.40	10.5	9.3
1	Top	IT-1	T	465.4	67.5	499.9	72.5	72.40	10.5	9.5
1	Middle	IT-2	T	461.9	67.0	493.0	71.5	73.09	10.6	9.5
5	Bottom	5T-3	T	468.9	68.0	499.9	72.5	71.02	10.3	9.5
			AVG:	465.4	67.5	497.8	72.2	72.40	10.5	9.5

* Location in a 5.08 cm (2.0 inch) thick plate

TABLE A-7: MECHANICAL PROPERTIES OF AS-RECEIVED 2124-T851 ALUMINUM ALLOY PLATE AT 450°K (350°F)

PLATE NO.	LOCATION*	SPECIMEN NO.	TEST DIRECTION	T _{ty}		F _{tu}		Modulus		Elongation, % (5.08cm gage length)
				MPa	ksi	MPa	ksi	10 ³ MPa	10 ⁶ psi	
2	Bottom	2L-3	L	365.4	53.0	375.8	54.5	61.16	8.87	16
3	Middle	3L-2	L	351.6	51.0	372.3	54.0	62.40	9.05	17
3	Bottom	3L-3	L	368.9	53.5	382.6	55.5	59.99	8.70	15
AVG:				361.98	52.5	377.2	54.7	61.16	8.87	16
5	Middle	5T-2	T	358.5	52.0	362.0	52.5	61.09	8.86	14
4	Middle	4T-2	T	**	**	368.9	53.5	**	**	14
4	Bottom	4T-3	T	365.4	53.0	376.5	54.5	63.57	9.22	15
AVG:				362.0	52.5	368.9	53.5	62.33	9.04	14

* Location in a 5.08 cm (2.0 inch) thick plate

** Extensometer slipped off specimen

FINAL REPORT

**FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851**

**NDC E1153
October 1974**

Appendix B

RESULTS OF ELASTIC COMPLIANCE CALIBRATION

The following data tables incorporate the compliance/crack length data obtained from calibrations of the center cracked tension specimen used in this program. Details concerning the test equipment and procedure used can be found in Section 3.1.

TABLE B-1

LOAD/DISPLACEMENT DATA FOR 2024-T861 SPECIMEN 63-2L4 AT
298°K (70°F), BUCKLING RESTRAINED
(thickness: 1.60 mm or .063 inch)

		RATIO OF CRACK LENGTH TO SPECIMEN WIDTH, 2a/w															
		.043	.085	.128	.171	.213	.256	.299	.341	.384	.427	.469	.512	.555	.597	.640	.683
MAX. APPLIED LOAD, P	MN Kips	0.071 16.0	0.053 12.0	0.044 10.0	0.036 8.0	0.031 7.0	0.027 6.0	0.027 6.0	0.022 5.0	0.022 5.0	0.022 5.0	0.018 4.0	0.018 4.0	0.018 4.0	0.013 3.0	0.013 3.0	0.013 3.0
DISPLACEMENTS AT:																	
0.5P	mm	0.0245	0.0376	0.0486	0.0511	0.0543	0.0553	0.0656	0.0628	0.0717	0.0813	0.0720	0.0880	0.0993	0.0823	0.0940	0.1078
	in	.964	1.481	1.914	2.012	2.137	2.179	2.584	2.472	2.822	3.199	2.836	3.464	3.911	3.241	3.702	4.246
0.6P	mm	0.0302	0.0465	0.0596	0.0625	0.0671	0.0685	0.0809	0.0777	0.0887	0.1004	0.0898	0.1075	0.1220	0.1008	0.1150	0.1313
	in	1.187	1.830	2.347	2.460	2.640	2.696	3.185	3.059	3.492	3.953	3.534	4.232	4.805	3.967	4.526	5.168
0.7P	mm	0.0355	0.0550	0.0706	0.0749	0.0802	0.08161	0.0965	0.0919	0.1050	0.1188	0.1065	0.1270	0.1444	0.1192	0.1359	0.1550
	in	1.397	2.165	2.780	2.947	3.157	3.213	3.799	3.618	4.135	4.679	4.191	5.001	5.685	4.693	5.350	6.104
0.8P	mm	0.0415	0.0639	0.0816	0.0866	0.0926	0.09474	0.1118	0.1068	0.1217	0.1377	0.1231	0.1465	0.1660	0.1387	0.1568	0.1785
	in	1.634	2.514	3.213	3.408	3.646	3.730	4.400	4.205	4.791	5.420	4.847	5.769	6.537	5.462	6.174	7.026
0.9P	mm	0.0475	0.0727	0.0933	0.0983	0.1054	0.1082	0.1270	0.1217	0.1384	0.1558	0.1398	0.1650	0.1884	0.1575	0.1785	0.2026
	in	1.872	2.864	3.674	3.869	4.149	4.260	5.001	4.791	5.448	6.132	5.504	6.495	7.417	6.202	7.026	7.976
P	mm	0.0532	0.0820	0.1047	0.1103	0.1185	0.1213	0.1426	0.1362	0.1547	0.1739	0.1561	0.1845	0.2107	0.1767	0.1994	0.2267
	in	2.095	3.227	4.121	4.344	4.666	4.777	5.615	5.364	6.090	6.845	6.146	7.264	8.297	6.956	7.850	8.926
COMPLIANCE, C	mm/MN	0.810	1.656	2.520	3.334	4.116	4.948	5.766	6.605	7.460	8.323	9.428	10.832	12.488	14.166	15.806	17.808
	10 ⁻⁶ in/lb	0.142	0.290	0.441	0.584	0.721	0.867	1.010	1.157	1.307	1.458	1.651	1.897	2.187	2.481	2.768	3.119

B-2

TABLE B-2
 LOAD/DISPLACEMENT DATA FOR 2024-T861 SPECIMEN 63-2L4 AT
 298°K (70°F), BUCKLING UNRESTRAINED
 (thickness: 1.60 mm or .063 inch)

		RATIO OF CRACK LENGTH TO SPECIMEN WIDTH, 2a/w										
		.043	.085	.128	.171	.213	.256	.299	.341	.384	.427	.469
MAX APPLIED, LOAD, P	MN	0.071	0.053	0.044	0.036	0.031	0.027	0.027	0.022	0.022	0.022	0.018
	Kips	16.0	12.0	10.0	8.0	7.0	6.0	6.0	5.0	5.0	5.0	4.0
DISPLACEMENTS AT:												
.5P	10 ⁻³ mm	0.0252	0.0398	0.0500	0.0521	0.0568	0.0578	0.0692	0.0663	0.0781	0.0919	0.0839
	in	0.992	1.565	1.928	2.053	2.235	2.277	2.724	2.612	3.073	3.618	3.283
.6P	10 ⁻³ mm	0.0309	0.0486	0.0600	0.0639	0.0692	0.0710	0.0845	0.0816	0.0958	0.1118	0.1029
	in	1.215	1.914	2.361	2.514	2.724	2.794	3.325	3.213	3.772	4.400	4.051
.7P	10 ⁻³ mm	0.0366	0.0571	0.0710	0.0756	0.0823	0.0837	0.0997	0.0958	0.1121	0.1313	0.1224
	in	1.439	2.249	2.794	2.975	3.241	3.297	3.925	3.772	4.414	5.168	4.819
.8P	10 ⁻³ mm	0.0426	0.0660	0.0816	0.0873	0.0947	0.0965	0.1150	0.1110	0.1292	0.1508	0.1416
	in	1.676	2.598	3.213	3.436	3.730	3.799	4.526	4.372	5.085	5.937	5.573
.9P	10 ⁻³ mm	0.0483	0.0749	0.0930	0.0990	0.1075	0.1100	0.1299	0.1260	0.1458	0.1703	0.1611
	in	1.900	2.947	3.660	3.897	4.232	4.330	5.113	4.959	5.741	6.705	6.342
P	10 ⁻³ mm	0.0543	0.0837	0.1043	0.1107	0.1203	0.1231	0.1451	0.1402	0.1622	0.1902	0.1820
	in	2.137	3.297	4.107	4.358	4.735	4.847	5.713	5.518	6.384	7.487	7.166
COMPLIANCE, C	mm/MN	0.817	1.646	2.482	3.290	4.082	4.883	5.686	6.646	7.548	8.819	11.029
	10 ⁻⁶ in/lb	0.143	0.288	0.435	0.576	0.715	0.855	0.996	1.164	1.322	1.545	1.932

TABLE B-3

LOAD/DISPLACEMENT DATA FOR 2024-T861 SPECIMEN 125-2L4 AT
298°K (70°F), BUCKLING RESTRAINED
(thickness: 3.18 mm or 0.125 inch)

		RATIO OF CRACK LENGTH TO SPECIMEN WIDTH, $2a/w$															
		.043	.085	.128	.170	.213	.255	.298	.340	.383	.426	.468	.511	.553	.596	.638	.681
MAX. APPLIED LOAD, P	MN	0.133	0.089	0.089	0.067	0.067	0.044	0.044	0.044	0.044	0.044	0.036	0.036	0.031	0.031	0.027	0.027
	Kips	30.0	20.0	20.0	15.0	15.0	10.0	10.0	10.0	10.0	10.0	8.0	8.0	7.0	7.0	6.0	6.0
DISPLACEMENTS AT:																	
.5P	mm	0.0238	0.0330	0.0497	0.0479	0.0600	0.0461	0.0564	0.0653	0.0763	0.0851	0.0766	0.873	0.0855	0.0990	0.0947	0.1082
	10 ⁻³ in	0.936	1.299	1.956	1.886	2.361	1.816	2.221	2.570	3.003	3.352	3.017	3.436	3.366	3.897	3.730	4.260
.6P	mm	0.0287	0.0401	0.0603	0.0582	0.0735	0.0568	0.0692	0.0802	0.0937	0.1047	0.0937	0.1068	0.1047	0.1199	0.1153	0.1302
	10 ⁻³ in	1.131	1.578	2.375	2.291	2.892	2.235	2.724	3.157	3.688	4.121	3.688	4.205	4.121	4.721	4.540	5.126
.7P	mm	0.0341	0.0472	0.0710	0.0685	0.0866	0.0678	0.0820	0.0951	0.1107	0.1238	0.1110	0.1260	0.1242	0.1416	0.1359	0.1529
	10 ⁻³ in	1.341	1.858	2.794	2.696	3.408	2.670	3.227	3.744	4.358	4.875	4.372	4.959	4.889	5.573	5.350	6.020
.8P	mm	0.0394	0.0546	0.0823	0.0791	0.1001	0.0788	0.0951	0.1100	0.1277	0.1433	0.1281	0.1458	0.1433	0.1632	0.1561	0.1760
	10 ⁻³ in	1.551	2.151	3.241	3.115	3.939	3.101	3.744	4.330	5.029	5.643	5.043	5.741	5.643	6.425	6.146	6.928
.9P	mm	0.0443	0.0617	0.0930	0.0905	0.1135	0.0901	0.1078	0.1252	0.1455	0.1625	0.1458	0.1650	0.1622	0.1845	0.1767	0.1990
	10 ⁻³ in	1.746	2.431	3.660	3.562	4.470	3.548	4.246	4.931	5.727	6.398	5.741	6.495	6.384	7.264	6.956	7.836
P	mm	0.0500	0.0688	0.1043	0.1008	0.1270	0.1011	0.1210	0.1405	0.1622	0.1824	0.1632	0.1845	0.1813	0.2054	0.1973	0.2221
	10 ⁻³ in	1.970	2.710	4.107	3.967	5.001	3.981	4.763	5.532	6.384	7.180	6.426	7.264	7.138	8.088	7.767	8.744
COMPLIANCE, C	mm/MN	0.393	0.808	1.228	1.592	2.008	2.479	2.903	3.380	3.865	4.362	4.869	5.464	6.154	6.861	7.676	8.554
	10 ⁻⁶ in/lb	0.069	0.142	0.215	0.279	0.352	0.434	0.508	0.592	0.677	0.764	0.853	0.957	1.078	1.201	1.344	1.498

TABLE B-4

LOAD/DISPLACEMENT DATA FOR 2024-T861 SPECIMEN 125-2L4 AT

298°K (70°F), BUCKLING UNRESTRAINED

(thickness: 3.18 mm or 0.125 inch)

		RATIO OF CRACK LENGTH TO SPECIMEN WIDTH, 2a/w															
		.043	.085	.128	.170	.213	.255	.298	.340	.383	.426	.468	.511	.553	.596	.638	.681
MAX APPLIED, LOAD, P	MN Kips	0.133 30.0	0.089 20.0	0.089 20.0	0.067 15.0	0.067 15.0	0.044 10.0	0.044 10.0	0.044 10.0	0.044 10.0	0.044 10.0	0.036 8.0	0.036 8.0	0.031 7.0	0.031 7.0	0.027 6.0	0.027 6.0
DISPLACEMENTS AT:																	
.5P	10 ⁻³ mm in	0.0245 0.964	0.0330 1.299	0.0514 2.025	0.0490 1.928	0.0617 2.431	0.0497 1.956	0.0585 2.305	0.0699 2.752	0.0805 3.171	0.0933 3.674	0.0841 3.311	0.0958 3.772	0.0937 3.688	0.1086 4.274	0.1061 4.177	0.1206 4.749
		0.0294 1.159	0.0398 1.565	0.0621 2.445	0.0593 2.333	0.0752 2.961	0.0607 2.389	0.0717 2.822	0.0848 3.339	0.0979 3.855	0.1135 4.470	0.1022 4.023	0.1164 4.582	0.1135 4.470	0.1313 5.168	0.1274 5.015	0.1451 5.713
.6P	10 ⁻³ mm in	0.0348 1.369	0.0472 1.858	0.0731 2.878	0.0699 2.752	0.0887 3.492	0.0717 2.822	0.0848 3.339	0.1004 3.953	0.1157 4.554	0.1338 5.266	0.1206 4.749	0.1366 5.378	0.1345 5.294	0.1540 6.062	0.1494 5.881	0.1700 6.691
		0.0398 1.565	0.0543 2.137	0.0837 3.297	0.0805 3.171	0.1022 4.023	0.0827 3.255	0.0983 3.869	0.1157 4.554	0.1334 5.252	0.1533 6.034	0.1384 5.448	0.1572 6.188	0.1543 6.076	0.1770 6.970	0.1717 6.761	0.1951 7.683
.7P	10 ⁻³ mm in	0.0451 1.774	0.0614 2.417	0.0947 3.730	0.0915 3.604	0.1157 4.554	0.0940 3.702	0.1114 4.386	0.1309 5.154	0.1508 5.937	0.1739 6.845	0.1568 6.174	0.1777 6.998	0.1746 6.873	0.2001 7.878	0.1941 7.641	0.2207 8.688
		0.0507 1.998	0.0685 2.696	0.1057 4.163	0.1022 4.023	0.1292 5.085	0.1054 4.149	0.1245 4.903	0.1465 5.769	0.1685 6.635	0.1937 7.627	0.1753 6.900	0.1987 7.822	0.1951 7.683	0.2232 8.786	0.2164 8.521	0.2462 9.694
.8P	10 ⁻³ mm in	0.0507 1.998	0.0685 2.696	0.1057 4.163	0.1022 4.023	0.1292 5.085	0.1054 4.149	0.1245 4.903	0.1465 5.769	0.1685 6.635	0.1937 7.627	0.1753 6.900	0.1987 7.822	0.1951 7.683	0.2232 8.786	0.2164 8.521	0.2462 9.694
		0.0451 1.774	0.0614 2.417	0.0947 3.730	0.0915 3.604	0.1157 4.554	0.0940 3.702	0.1114 4.386	0.1309 5.154	0.1508 5.937	0.1739 6.845	0.1568 6.174	0.1777 6.998	0.1746 6.873	0.2001 7.878	0.1941 7.641	0.2207 8.688
.9P	10 ⁻³ mm in	0.0451 1.774	0.0614 2.417	0.0947 3.730	0.0915 3.604	0.1157 4.554	0.0940 3.702	0.1114 4.386	0.1309 5.154	0.1508 5.937	0.1739 6.845	0.1568 6.174	0.1777 6.998	0.1746 6.873	0.2001 7.878	0.1941 7.641	0.2207 8.688
		0.0507 1.998	0.0685 2.696	0.1057 4.163	0.1022 4.023	0.1292 5.085	0.1054 4.149	0.1245 4.903	0.1465 5.769	0.1685 6.635	0.1937 7.627	0.1753 6.900	0.1987 7.822	0.1951 7.683	0.2232 8.786	0.2164 8.521	0.2462 9.694
P	10 ⁻³ mm in	0.0507 1.998	0.0685 2.696	0.1057 4.163	0.1022 4.023	0.1292 5.085	0.1054 4.149	0.1245 4.903	0.1465 5.769	0.1685 6.635	0.1937 7.627	0.1753 6.900	0.1987 7.822	0.1951 7.683	0.2232 8.786	0.2164 8.521	0.2462 9.694
		0.0507 1.998	0.0685 2.696	0.1057 4.163	0.1022 4.023	0.1292 5.085	0.1054 4.149	0.1245 4.903	0.1465 5.769	0.1685 6.635	0.1937 7.627	0.1753 6.900	0.1987 7.822	0.1951 7.683	0.2232 8.786	0.2164 8.521	0.2462 9.694
COMPLIANCE, C	mm/MN 10 ⁻⁶ in/lb	0.392 0.069	0.801 0.140	1.221 0.214	1.600 0.280	2.021 0.354	2.502 0.438	2.971 0.520	3.447 0.604	3.959 0.693	4.512 0.790	5.118 0.896	5.773 1.011	6.518 1.141	7.364 1.290	8.287 1.451	9.419 1.650

TABLE B-5

LOAD/DISPLACEMENT DATA FOR 2024-T861 SPECIMEN 250-4T4 AT 144°K (-200°F)
(thickness: 6.30 mm or .248 inch)

MAX. APPLIED LOAD, P	MN Kips	RATIO OF CRACK LENGTH TO SPECIMEN WIDTH, 2a/w							
		0.085	.170	.256	.341	.426	.511	.596	.681
DISPLACEMENT AT:		0.200 45.0	0.133 30.0	0.111 25.0	0.089 20.0	0.080 18.0	0.067 15.0	0.058 13.0	0.044 10.0
0.5P	10 ⁻³ mm in	0.0309 1.215	0.0415 1.634	0.0507 1.998	0.0539 2.123	0.0710 2.794	0.0805 3.171	0.0728 3.101	0.0855 3.365
0.6P	10 ⁻³ mm in	0.0369 1.453	0.0511 2.012	0.0617 2.431	0.0660 2.598	0.0851 3.352	0.0965 3.799	0.0951 3.744	0.1015 3.995
0.7P	10 ⁻³ mm in	0.429 1.690	0.0600 2.361	0.0731 2.878	0.0781 3.073	0.0993 3.911	0.1121 4.414	0.1114 4.386	0.1175 4.624
0.8P	10 ⁻³ mm in	0.0497 1.956	0.0685 2.696	0.0851 3.352	0.0905 3.562	0.1139 4.484	0.1277 5.029	0.1270 5.000	0.1338 5.266
0.9P	10 ⁻³ mm in	0.0553 2.179	0.0777 3.059	0.0955 3.758	0.1029 4.051	0.1284 5.057	0.1437 5.657	0.1433 5.643	0.1497 5.895
P	10 ⁻³ mm in	0.0617 2.431	0.0866 3.408	0.1078 4.246	0.1150 4.526	0.1426 5.615	0.1597 6.286	0.1597 6.286	0.1664 6.551
COMPLIANCE, C	mm/MN 10 ⁻⁶ in/lb	0.309 0.054	0.671 0.118	1.024 0.179	1.376 0.241	1.794 0.314	2.367 0.415	2.791 0.489	3.633 .636

TABLE B-6

LOAD/DISPLACEMENT DATA FOR 2024-T861 SPECIMEN 250-4T4 AT 298°K (70°F)
(thickness: 6.30 mm or .248 inch)

		RATIO OF CRACK LENGTH TO SPECIMEN WIDTH, 2c/w															
		0.043	0.085	.128	.170	.213	.256	.298	.341	.383	.426	.469	.511	.554	.596	.639	.681
MAX. APPLIED LOAD, P	MN	0.267	0.200	0.156	0.133	0.111	0.111	0.089	0.089	0.089	0.080	0.076	0.067	0.062	0.058	0.053	0.044
	Kips	60.0	45.0	35.0	30.0	25.0	25.0	20.0	20.0	20.0	18.0	17.0	15.0	14.0	13.0	12.0	10.0
DISPLACEMENTS AT:																	
0.5P	10 ⁻³ mm	0.0248	0.0394	0.0444	0.0497	0.0518	0.0631	0.0600	0.0692	0.0788	0.0813	0.0859	0.0851	0.0873	0.0905	0.0958	0.0919
	in	.978	1.551	1.746	1.956	2.039	2.486	2.361	2.724	3.101	3.199	3.380	3.352	3.436	3.562	3.772	3.618
0.6P	10 ⁻³ mm	0.0302	0.0472	0.0539	0.0600	0.0624	0.0759	0.0723	0.0834	0.0944	0.0983	0.1040	0.1025	0.1065	0.1100	0.1160	0.1114
	in	1.187	1.858	2.123	2.361	2.458	2.989	2.850	3.283	3.716	3.869	4.093	4.037	4.191	4.330	4.568	4.386
0.7P	10 ⁻³ mm	0.0355	0.0553	0.0628	0.0699	0.0731	0.0894	0.0848	0.0983	0.1118	0.1157	0.1224	0.1213	0.1249	0.1288	0.1359	0.1309
	in	1.397	2.179	2.472	2.752	2.878	3.520	3.339	3.870	4.400	4.554	4.819	4.777	4.917	5.071	5.350	5.154
0.8P	10 ⁻³ mm	0.0408	0.0635	0.0720	0.0805	0.0837	0.1029	0.0976	0.1128	0.1281	0.1323	0.1405	0.1394	0.1433	0.1490	0.1568	0.1501
	in	1.606	2.500	2.836	3.171	3.297	4.051	3.841	4.442	5.043	5.210	5.532	5.490	5.643	5.867	6.174	5.909
0.9P	10 ⁻³ mm	0.0461	0.0720	0.0809	0.0912	0.0944	0.1160	0.1096	0.1274	0.144*	0.1494	0.1586	0.1575	0.1625	0.1689	0.1763	0.1700
	in	1.816	2.836	3.185	3.590	3.716	4.568	4.316	5.015	5.685	5.881	6.244	6.202	6.398	6.649	6.942	6.691
P	10 ⁻³ mm	0.0514	0.0802	0.0905	0.1018	0.1050	0.1288	0.1228	0.1416	0.1618	0.1660	0.1770	0.1756	0.1810	0.1891	0.1973	0.1895
	in	2.025	3.157	3.562	4.009	4.135	5.071	4.833	5.573	6.370	6.537	6.970	6.914	7.124	7.445	7.767	7.459
COMPLIANCE, C	mm/MN	0.199	0.409	0.588	0.782	0.959	1.188	1.410	1.633	1.867	2.118	2.410	2.724	3.004	3.409	3.797	4.385
	10 ⁻⁶ in/lb	0.0349	0.0717	0.103	0.137	0.168	0.208	0.247	0.286	0.327	0.371	0.422	0.477	0.526	0.597	0.665	0.768

TABLE B-7

LOAD/DISPLACEMENT DATA FOR 2024-T861 SPECIMEN 250-4T4 AT 450°K (350°F)

(thickness: 6.30 mm or .248 inch)

		RATIO OF CRACK LENGTH TO SPECIMEN WIDTH, 2c/w							
		0.085	0.170	0.256	0.341	0.426	0.511	0.596	0.681
MAX. APPLIED LOAD, P	MN	0.200	0.133	0.111	0.089	0.080	0.067	0.058	0.044
	Kips	45.0	30.0	25.0	20.0	18.0	15.0	13.0	10.0
DISPLACEMENTS AT:									
0.5P	mm	0.0429	0.0543	0.0575	0.0635	0.0741	0.0851	0.1040	0.1022
	in	1.690	2.137	2.263	2.500	2.919	3.352	4.093	4.023
0.6P	mm	0.0518	0.0656	0.0717	0.0791	0.0927	0.1047	0.1260	0.1235
	in	2.039	2.584	2.822	3.115	3.650	4.121	4.959	4.861
0.7P	mm	0.0607	0.0766	0.0859	0.0951	0.1114	0.1245	0.1480	0.1444
	in	2.389	3.017	3.380	3.744	4.386	4.903	5.825	5.685
0.8P	mm	0.0699	0.0876	0.1001	0.1110	0.1302	0.1448	0.1700	0.1660
	in	2.752	3.450	3.939	4.372	5.126	5.699	6.691	6.537
0.9P	mm	0.0791	0.0993	0.1146	0.1267	0.1497	0.1639	0.1923	0.1884
	in	3.115	3.911	4.512	4.987	5.895	6.453	7.571	7.417
P	mm	0.0887	0.1107	0.1292	0.1423	0.1678	0.1842	0.2136	0.2093
	in	3.492	4.358	5.085	5.601	6.607	7.250	8.409	8.241
COMPLIANCE, C	mm/MN	0.458	0.845	1.290	1.776	2.393	2.969	3.803	4.831
	10 ⁻⁶ in/lb	0.0802	0.148	0.226	0.311	0.419	0.520	0.666	0.846

TABLE B-8

LOAD/DISPLACEMENT DATA FOR 2124-T851 SPECIMEN 1T7-453-1 AT 298°K (70°F)

(thickness: 11.43 mm or .450 inch)

MAX. APPLIED LOAD	MM Kips	RATIO OF CRACK LENGTH TO SPECIMEN WIDTH, 2c/w															
		0.043	0.085	0.128	0.171	0.213	0.256	0.299	0.341	0.384	0.426	0.469	0.512	0.554	0.597	0.640	0.682
		0.578	0.400	0.311	0.267	0.222	0.222	0.177	0.179	0.177	0.133	0.133	0.133	0.133	0.111	0.111	0.111
		130	90.0	70.0	60.0	50.0	50.0	40.0	40.0	40.0	30.0	30.0	30.0	30.0	25.0	25.0	25.0
DISPLACEMENTS AT:																	
0.5P	10 ⁻³ mm	0.0366	0.0482	0.0554	0.0638	0.0661	0.0789	0.0761	0.0884	0.1002	0.0879	0.0985	0.1097	0.1232	0.1159	0.1293	0.1433
	in	1.441	1.896	2.182	2.513	2.601	3.108	2.998	3.482	3.945	3.460	3.879	4.320	4.849	4.563	5.092	5.643
0.6P	10 ⁻³ mm	0.0425	0.0577	0.0661	0.0756	0.0789	0.0935	0.0896	0.1041	0.1181	0.1030	0.1159	0.1293	0.1445	0.1360	0.1523	0.1685
	in	1.675	2.270	2.601	2.976	3.108	3.681	3.527	4.100	4.651	4.056	4.563	5.092	5.687	5.356	5.995	6.634
0.7P	10 ⁻³ mm	0.0498	0.0666	0.0767	0.0879	0.0907	0.1086	0.1036	0.1198	0.1366	0.1181	0.1332	0.1489	0.1663	0.1568	0.1752	0.1943
	in	1.962	2.623	3.020	3.460	3.571	4.276	4.078	4.717	5.378	4.651	5.246	5.863	6.546	6.172	6.899	7.648
0.8P	10 ⁻³ mm	0.0571	0.0761	0.0879	0.1002	0.1030	0.1237	0.1176	0.1360	0.1551	0.1332	0.1506	0.1691	0.1892	0.1775	0.1988	0.2206
	in	2.248	2.998	3.460	3.945	4.056	4.871	4.629	5.356	6.105	5.246	5.929	6.656	7.450	6.987	7.825	8.684
0.9P	10 ⁻³ mm	0.0638	0.0856	0.0985	0.1120	0.1159	0.1383	0.1310	0.1523	0.1730	0.1495	0.1679	0.1892	0.2111	0.1982	0.2211	0.2458
	in	2.513	3.372	3.879	4.408	4.563	5.444	5.158	5.995	6.811	5.885	6.612	7.450	8.310	7.803	8.706	9.676
P	10 ⁻³ mm	0.0711	0.0952	0.1092	0.1243	0.1276	0.1539	0.1456	0.1685	0.1920	0.1652	0.1864	0.2088	0.2335	0.2183	0.2441	0.2721
	in	2.799	3.747	4.298	4.893	5.025	6.061	5.731	6.634	7.560	6.502	7.340	8.221	9.191	8.596	9.610	10.712
COMPLIANCE, C	mm/MN	0.120	0.234	0.348	0.451	0.554	0.674	0.777	0.902	1.034	1.159	1.313	1.490	1.656	1.850	2.067	2.318
	10 ⁻⁶ in/lb	0.021	0.041	0.061	0.079	0.097	0.118	0.136	0.158	0.181	0.203	0.230	0.261	0.290	0.324	0.362	0.406

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2024-T861 AND 2124-T851

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APPENDIX C

FRACTURE TOUGHNESS TEST DATA

This appendix contains all the fracture toughness test data generated under the program. Because of the great quantity of data, it is divided into sections according to alloy, specimen thickness, and buckling constraint, as follows:

<u>Section</u>	<u>Alloy</u>	<u>Nominal Specimen Thickness</u>		<u>Constraint</u>
		<u>mm</u>	<u>in</u>	
C1	2024-T861	1.60	.063	Stiffened
C2	2024-T861	1.60	.063	Unstiffened
C3	2024-T861	3.18	.125	Stiffened
C4	2024-T861	3.18	.125	Unstiffened
C5	2024-T861	6.35	.250	Unstiffened
C6	2124-T851	6.35	.250	Unstiffened
C7	2124-T851	11.43	.450	Unstiffened

The data in each section is presented in both graphical and tabular format. At the beginning of each section, a summary table is provided which includes pertinent specimen test data, critical stress intensity (K_{IC}) values, and information as to the location of the tabular and graphical fracture resistance data for each specimen. The critical stress intensity values listed in these summary tables were obtained from the fracture resistance curve for each specimen, as described in Section 3.4. For some specimens, no K_{IC} values are reported because net section yielding occurred prior to fracture; such instances are denoted by (*).

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2024-T861 AND 2124-T851

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SECTION C1. FRACTURE TOUGHNESS TEST DATA FOR 1.60 mm
(.063 INCH) THICK 2024-T861, BUCKLING RESTRAINED.

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TABLE C1-1.
Fracture Toughness Test Data for 2024-T861 Specimens
(1.60 mm (.063 inch) Thick, Buckling Restrained)

Specimen Number	Temperature (K)	Orientation	Specimen Dimensions		Precrack Length		Precrack Load		Failure Load		Full Section Failure Stress		Critical Stress Intensity, K _{IC}		Data Table No.	Figure No.
			Thickness mm	Width in	mm	in	kN	kip	kN	kip	MPa	ksi	MPa√m	ksi√in		
63-1L10	144	L	1.65	.0648	29.787	11.727	82.73	3.26	26.7	6.0	62.6	14.1	127.8	18.5	61.4	55.9
63-1L14	144	L	1.65	.0649	29.799	11.732	88.09	3.47	26.7	6.0	70.6	15.9	143.7	20.8	55.4	50.4
63-2L3	144	L	1.64	.0647	29.756	11.715	25.35	1.00	53.4	12.0	122.1	27.5	249.7	36.2	58.4	53.2
63-4L4	144	L	1.63	.0540	29.794	11.730	12.75	.50	84.5	19.0	167.3	37.6	345.4	50.1	AVG: 58.4	53.2
63-6L7	294	L	1.64	.0647	29.812	11.737	81.76	3.22	31.1	7.0	68.3	15.4	139.4	20.2	61.0	55.5
63-1L16	294	L	1.64	.0644	29.807	11.735	48.62	1.91	44.5	10.0	93.6	21.0	192.1	27.9	56.7	51.6
63-6L6	294	L	1.65	.0648	29.784	11.726	12.17	.48	89.0	20.0	169.5	38.1	345.6	50.1	AVG: 60.9	55.4
63-6L5	450	L	1.65	.0648	29.782	11.725	98.42	3.88	48.9	11.0	111.2	25.0	226.9	32.9	NSY	NSY
63-2L14	450	L	1.64	.0644	29.789	11.728	80.62	3.17	35.6	8.0	115.2	25.9	236.5	34.3	NSY	NSY
63-2L8	450	L	1.64	.0644	29.779	11.724	63.09	2.48	62.3	14.0	136.8	30.7	280.8	40.7	NSY	NSY
63-6T2	144	T	1.65	.0650	29.799	11.732	88.54	3.49	22.2	5.0	53.0	11.9	107.7	15.6	44.1	40.2
63-5T12	144	T	1.66	.0652	29.794	11.730	25.17	.99	48.9	11.0	99.2	22.3	201.1	29.2	50.3	45.8
63-3T8	144	T	1.63	.0643	29.774	11.722							AVG: 47.2		43.0	
63-3T4	294	T	1.63	.0640	29.782	11.725	81.79	3.22	26.7	6.8	66.9	15.1	138.3	20.1	56.1	51.1
63-6T1	294	T	1.64	.0647	29.782	11.725	43.36	1.71	44.5	10.0	85.9	19.3	175.4	25.4	52.6	47.8
63-3T9	294	T	1.63	.0640	29.794	11.730	12.40	.49	80.1	18.0	139.0	31.3	287.0	41.6	49.7	45.2
													AVG: 52.8		48.0	
63-5T11	450	T	1.67	.0658	29.789	11.728	98.42	3.88	44.5	10.0	97.4	21.9	195.7	28.4	NSY	NSY
63-6T5	450	T	1.64	.0647	29.771	11.721	63.63	2.50	57.8	13.0	105.9	23.8	216.4	31.4	NSY	NSY
63-7T2	450	T	1.66	.0652	29.771	11.721	81.61	3.21	35.6	8.0	109.2	24.5	221.5	32.1	NSY	NSY

* Compliance gage slipped on knife edges.

** Recorder malfunction prior to failure.

+ Specimen failed in the grips.

NSY Net section stress greater than 0.2 percent offset yield strength prior to failure.

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TABLE C1-2

SPECIMEN NUMBER: 63-1L14
ALLOY: 2024-T861
ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 144.0 K
SPECIMEN THICKNESS: 1.64 MM (.064 IN)
K (MAX) DURING PRECRACKING: 21.54 MPA SQRT(M) (19.63 KSI SQRT(IN))

KN	LOAD KIPS	COU		A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS		NET SECTION	
		E-3 MM	E-3 IN	MM	IN	MM	IN	MPA SQRT(M)	KSI SQRT(IN)	MPA	KSI	MPA	KSI
0.0	0.0	0.00	0.00	44.14	1.734	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00
86.7	19.4	376.68	14.83	44.22	1.741	.18	.007	53.98	49.13	136.96	19.89	194.69	28.23
88.9	19.8	396.24	15.61	44.30	1.764	.76	.030	56.23	51.17	141.47	20.52	202.29	29.74
94.1	21.1	422.06	16.64	46.31	1.831	2.47	.097	58.53	53.27	143.84	20.86	209.12	30.33
96.0	21.5	444.75	17.51	48.14	1.895	4.09	.161	60.24	54.82	144.84	21.00	213.37	31.03
97.3	21.8	477.77	18.81	51.14	2.010	7.00	.276	62.31	56.74	144.21	20.91	219.35	31.81

TABLE C1-3

SPECIMEN NUMBER: 63-2L3
ALLOY: 2024-T861
ORIENTATION: LONGITUDINAL
CONSTRAINT: STIFFENED
TEST TEMPERATURE: 144.0 K
SPECIMEN THICKNESS: 1.64 MM (.065 IN)
K (MAX) DURING PRECRACKING: 21.88 MPA SQRT(M) (19.92 KSI SQRT(IN))

KN	LOAD KIPS	COU		A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS		NET SECTION	
		E-3 MM	E-3 IN	MM	IN	MM	IN	MPA SQRT(M)	KSI SQRT(IN)	MPA	KSI	MPA	KSI
0.0	0.0	0.00	0.00	12.67	.499	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00
10.0	2.2	55.7	2.19	13.03	.515	.16	.006	13.31	12.57	68.47	9.83	74.00	10.71
12.0	2.7	67.0	2.64	13.09	.516	.41	.016	22.03	20.79	111.39	16.03	124.00	17.38
14.0	3.1	77.0	3.03	13.02	.515	.15	.006	27.01	24.53	133.00	19.22	146.00	20.69
16.0	3.5	87.0	3.43	13.01	.514	.13	.005	33.03	30.63	165.00	23.44	181.00	25.59
18.0	4.0	97.0	3.83	13.06	.514	.39	.015	36.00	33.32	179.00	25.49	197.00	27.69
20.0	4.4	107.0	4.23	13.24	.521	.87	.022	46.00	42.10	198.00	28.09	218.00	30.79
22.0	4.9	117.0	4.63	13.55	.533	1.08	.034	43.51	40.15	199.00	28.13	220.00	31.00
24.0	5.3	127.0	5.03	13.75	.542	1.47	.043	46.00	42.08	200.00	28.18	221.00	31.11
26.0	5.8	137.0	5.43	13.93	.553	1.11	.044	48.00	44.34	200.00	28.18	221.00	31.11
28.0	6.2	147.0	5.83	14.15	.557	1.46	.058	51.00	46.88	200.00	28.18	221.00	31.11
30.0	6.6	157.0	6.23	14.70	.582	2.11	.083	54.00	49.29	200.00	28.18	221.00	31.11
32.0	7.0	167.0	6.63	14.94	.594	2.46	.097	55.35	51.37	200.00	28.18	221.00	31.11

TABLE C1-4

SPECIMEN NUMBER: 63-4L4
ALLOY: 2024-T861
ORIENTATION: TRANSVERSE
CONSTRAINT: STIFFENED
TEST TEMPERATURE: 144.0 K
SPECIMEN THICKNESS: 1.63 MM (.064 IN)
K (MAX) DURING PRECRACKING: 24.72 MPA SQRT (M) (22.50 KSI SQRT (IN))

LOAD		COD		A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS		FULL SECTION		NET SECTION	
KN	KIPS	E-3 MM	E-3 IN	MM	IN	MM	IN	MPA SQRT (M)	KSI SQRT (IN)	MPA	KSI	MPA	KSI	MPA	KSI
1.1	0.25	3.00	0.12	6.38	.251	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.2	0.50	3.00	0.12	7.13	.281	.76	.030	2.57	2.30	0.00	0.00	0.00	0.00	0.00	0.00
3.3	0.75	3.00	0.12	7.13	.281	.47	.019	2.57	2.30	0.00	0.00	0.00	0.00	0.00	0.00
4.4	1.00	3.00	0.12	6.38	.251	.57	.022	3.16	2.88	0.00	0.00	0.00	0.00	0.00	0.00
5.5	1.25	3.00	0.12	7.13	.281	.65	.026	3.16	2.88	0.00	0.00	0.00	0.00	0.00	0.00
6.6	1.50	3.00	0.12	7.13	.281	.81	.031	3.16	2.88	0.00	0.00	0.00	0.00	0.00	0.00
7.7	1.75	3.00	0.12	7.13	.281	.83	.033	3.16	2.88	0.00	0.00	0.00	0.00	0.00	0.00
8.8	2.00	3.00	0.12	7.13	.281	1.15	.045	3.16	2.88	0.00	0.00	0.00	0.00	0.00	0.00
9.9	2.25	3.00	0.12	7.13	.281	1.56	.062	3.16	2.88	0.00	0.00	0.00	0.00	0.00	0.00
11.0	2.50	3.00	0.12	7.13	.281	1.77	.071	3.16	2.88	0.00	0.00	0.00	0.00	0.00	0.00
12.1	2.75	3.00	0.12	7.13	.281	2.06	.081	3.16	2.88	0.00	0.00	0.00	0.00	0.00	0.00
13.2	3.00	3.00	0.12	7.13	.281	2.13	.084	3.16	2.88	0.00	0.00	0.00	0.00	0.00	0.00
14.3	3.25	3.00	0.12	7.13	.281	2.66	.105	3.16	2.88	0.00	0.00	0.00	0.00	0.00	0.00
15.4	3.50	3.00	0.12	7.13	.281	2.79	.110	3.16	2.88	0.00	0.00	0.00	0.00	0.00	0.00

TABLE C1-5

SPECIMEN NUMBER: 63-6L7
ALLOY: 2024-T861
ORIENTATION: LONGITUDINAL
CONSTRAINT: STIFFENED
TEST TEMPERATURE: 294.3 K
SPECIMEN THICKNESS: 1.64 MM (.065 IN)
K (MAX) DURING PRECRACKING: 23.89 MPA SQRT (M) (21.75 KSI SQRT (IN))

LOAD		COD		A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS		FULL SECTION		NET SECTION	
KN	KIPS	E-3 MM	E-3 IN	MM	IN	MM	IN	MPA SQRT (M)	KSI SQRT (IN)	MPA	KSI	MPA	KSI	MPA	KSI
1.1	0.25	0.00	0.00	4.08	1.609	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.2	0.50	0.00	0.00	4.14	1.630	.93	.021	2.18	1.98	0.00	0.00	0.00	0.00	0.00	0.00
3.3	0.75	0.00	0.00	4.14	1.630	.93	.021	2.18	1.98	0.00	0.00	0.00	0.00	0.00	0.00
4.4	1.00	0.00	0.00	4.14	1.630	1.00	.024	2.18	1.98	0.00	0.00	0.00	0.00	0.00	0.00
5.5	1.25	0.00	0.00	4.14	1.630	1.00	.024	2.18	1.98	0.00	0.00	0.00	0.00	0.00	0.00
6.6	1.50	0.00	0.00	4.14	1.630	1.00	.024	2.18	1.98	0.00	0.00	0.00	0.00	0.00	0.00
7.7	1.75	0.00	0.00	4.14	1.630	1.00	.024	2.18	1.98	0.00	0.00	0.00	0.00	0.00	0.00
8.8	2.00	0.00	0.00	4.14	1.630	1.00	.024	2.18	1.98	0.00	0.00	0.00	0.00	0.00	0.00
9.9	2.25	0.00	0.00	4.14	1.630	1.00	.024	2.18	1.98	0.00	0.00	0.00	0.00	0.00	0.00
11.0	2.50	0.00	0.00	4.14	1.630	1.00	.024	2.18	1.98	0.00	0.00	0.00	0.00	0.00	0.00
12.1	2.75	0.00	0.00	4.14	1.630	1.00	.024	2.18	1.98	0.00	0.00	0.00	0.00	0.00	0.00
13.2	3.00	0.00	0.00	4.14	1.630	1.00	.024	2.18	1.98	0.00	0.00	0.00	0.00	0.00	0.00
14.3	3.25	0.00	0.00	4.14	1.630	1.00	.024	2.18	1.98	0.00	0.00	0.00	0.00	0.00	0.00
15.4	3.50	0.00	0.00	4.14	1.630	1.00	.024	2.18	1.98	0.00	0.00	0.00	0.00	0.00	0.00

C-6
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TABLE C1-6

SPECIMEN NUMBER:
ALL OY:
ORIENTATION:
CONSTRAINT:
TEST TEMPERATURE:
SPECIMEN THICKNESS:
K (MAX) DURING PRECRACKING:

63-1116
2024-T861
LONGITUDINAL
STIFFENED
294.0 K
1.64 MM (.064 IN)
25.63 MPA SQRT(M) (23.33 KSI SQRT(IN))

[illegible]

TABLE C1-7

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SPECIMEN NUMBER:
      ALLOY:
      ORIENTATION:
      CONSTRAINT:
      TEST TEMPERATURE:
SPECIMEN THICKNESS:
K (MAX) DURING PRECRACKING:

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63-616
2024-T861
LONGITUDINAL
STIFFENED
294.0 K
(.065 IN)
1.65 MM
25.11 MPA SQRT(M) (22.85 KSI SQRT(IN))

[illegible]

TABLE C1-8

SPECIMEN NUMBER: 63-EL5
ALLOY: 2024-T861
ORIENTATION: LONGITUDINAL
CONSTRAINT: STIFFENED
TEST TEMPERATURE: 45J.0 K
SPECIMEN THICKNESS: 1.65 MM (0.065 IN)
K(MAX) DURING PRECRACKING: 42.12 MPA SQR(T(M)) (38.33 KSI SQR(T(IN))

LOAD	KN	KIPS	COD E-3 MM	E-3 IN	A, HALF CRACK LENGTH		DELTA A MM	IN	STRESS INTENSITY		FULL SECTION		STRESS NET SECTION	
					MM	IN			MPA SQR(T(M))	KSI SQR(T(IN))	MPA	KSI	MPA	KSI
0.0	0.0	0.0	0.00	0.00	49.21	1.937	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00
47.0	10.7	2.4	337.44	13.29	49.71	1.957	0.019	0.019	41.89	37.60	96.77	14.03	145.29	20.96
56.4	12.7	2.8	413.14	16.27	51.36	1.983	0.045	0.045	49.33	44.89	115.16	16.70	174.44	24.64
66.5	14.5	3.2	493.77	19.44	53.64	2.083	0.096	0.096	57.30	52.15	131.59	19.38	201.44	28.33
71.3	16.0	3.5	572.49	22.54	55.04	2.088	0.151	0.151	64.31	58.71	145.51	21.10	226.00	31.70
75.3	17.1	3.8	649.37	25.57	55.84	2.173	0.239	0.239	70.39	64.24	154.93	22.47	246.20	34.33
78.8	17.7	3.9	715.83	28.79	56.84	2.215	0.300	0.300	74.35	68.02	160.74	23.31	259.98	36.44
80.0	18.1	4.0	761.35	30.47	58.83	2.315	0.440	0.440	82.52	75.10	169.88	24.66	280.31	39.44
83.3	18.7	4.1	821.73	32.35	60.33	2.379	0.475	0.475	83.96	76.41	171.02	24.83	289.57	40.44
84.4	18.8	4.1	846.10	33.31	61.27	2.412	0.494	0.494	85.00	77.35	172.11	24.96	294.06	41.33
84.6	19.0	4.2	862.66	33.96	61.76	2.433	0.498	0.498	85.64	77.93	172.67	25.04	296.21	41.66
84.7	19.0	4.2	873.38	34.38	62.11	2.445	0.508	0.508	86.55	78.77	172.81	25.05	299.26	41.96
84.7	19.0	4.2	891.62	35.10	62.92	2.477	0.540	0.540						

TABLE C1-9

SPECIMEN NUMBER: 63-2L14
ALLOY: 2024-T861
ORIENTATION: LONGITUDINAL
CONSTRAINT: STIFFENED
TEST TEMPERATURE: 45J.0 K
SPECIMEN THICKNESS: 1.64 MM (0.064 IN)
K(MAX) DURING PRECRACKING: 27.23 MPA SQR(T(M)) (24.78 KSI SQR(T(IN))

LOAD	KN	KIPS	COD E-3 MM	E-3 IN	A, HALF CRACK LENGTH		DELTA A MM	IN	STRESS INTENSITY		FULL SECTION		STRESS NET SECTION	
					MM	IN			MPA SQR(T(M))	KSI SQR(T(IN))	MPA	KSI	MPA	KSI
0.0	0.0	0.0	0.00	0.00	46.31	1.587	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00
88.0	19.9	4.4	573.35	22.57	43.33	1.708	0.012	0.012	71.80	64.43	181.65	26.34	256.34	37.17
93.3	21.0	4.6	665.47	26.22	45.33	1.830	0.203	0.203	77.85	70.85	191.36	27.75	278.10	39.36
94.4	21.2	4.7	692.90	27.68	47.41	1.867	0.280	0.280	79.76	72.59	193.63	28.13	284.48	39.88
98.0	22.1	4.9	753.97	29.68	48.54	1.911	0.324	0.324	84.52	76.92	212.12	31.12	308.80	43.24
103.3	23.3	5.2	834.91	32.87	50.13	1.976	0.369	0.369	96.36	82.23	211.43	31.51	318.57	44.68
105.0	23.8	5.3	850.35	33.88	51.33	2.046	0.459	0.459	95.01	86.47	217.31	32.51	333.33	46.99
108.0	24.4	5.4	956.73	37.67	52.00	2.081	0.494	0.494	89.50	89.35	222.38	32.85	344.44	48.00
109.0	24.6	5.5	994.14	39.97	54.00	2.129	0.502	0.502	100.42	91.39	223.55	33.05	350.66	48.88
110.0	24.8	5.5	1015.19	40.31	54.94	2.149	0.527	0.527			224.87	33.61	355.44	49.73
112.0	25.2	5.6	1160.24	45.74	55.99	2.191	0.604	0.604			227.04	34.01	363.53	50.90
112.0	25.2	5.6	1170.19	46.47	58.79	2.314	0.727	0.727			231.06	35.91	381.24	53.66
113.0	25.5	5.7	1275.19	50.20	61.71	2.430	0.843	0.843			233.44	36.86	398.08	55.60
114.0	25.7	5.7	1311.45	51.63	62.90	2.461	0.909	0.909			234.95	37.47	404.44	56.66
114.0	25.8	5.8	1373.31	54.07	64.33	2.532	0.945	0.945			235.39	37.44	414.44	58.00

TABLE C1-10

SPECIMEN NUMBER:	ALL 014	63-218
ORIENTATION:	CONSTRAINT:	2024-T861
TEST TEMPERATURE:	SPECIMEN THICKNESS:	LONGITUDINAL
SPECIMEN THICKNESS:	DURING PRECRACKING:	STIFFNESS
K (MAX)	41.40 MPA SQRT(M) (37.68 KSI SQRT(IN))	450.0 K
		1.64 MM 1.64 IN

[illegible]

TABLE C1-11

	SPECIMEN NUMBER:	63-6T2
	ALLOY:	2024-TAG1
	ORIENTATION:	TRANSVERSE
	CONSTRAINT:	STIFFENED
	TEST TEMPERATURE:	144.0 C K
	SPECIMEN THICKNESS:	1.65 MM (0.065 IN)
K (MAX)	DURING PRECRACKING:	17.84 MPA SQRT (M) (16.24 KSI SQRT (IN))

LOAD		COD		A HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS		NET SECTION	
KN	KIPS	E-3 MM	E-3 IN	MM	IN	MM	IN	MPA	SQRT(M)	KSI	SQRT(IN)	MPA	KSI
0.0	0.0	0.00	0.00	44.27	1.743	0.60	0.000	0.00	0.60	0.00	0.00	0.00	0.00
0.5	1.1	28.89	11.33	44.60	1.756	0.33	0.013	41.55	37.77	114.70	15.18	149.42	21.67
1.0	2.2	39.74	15.59	44.72	1.761	0.46	0.018	42.73	38.89	137.63	15.61	153.79	22.30
1.5	3.3	42.00	16.53	44.74	1.762	0.59	0.023	43.96	39.99	140.56	15.74	156.84	22.53
2.0	4.4	42.00	16.53	47.54	1.872	3.27	0.129	44.28	40.30	107.32	15.56	157.61	22.86

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TABLE C1-12

SPECIMEN NUMBER:
ALLLOY:
ORIENTATION:
CONSTRAINT:
TEST TEMPERATURE:
SPECIMEN THICKNESS:
K (MAX) DURING PRECRACKING:

19.91 MPA SQRT(M) (19.02 KSI SQRT(IN))

[illegible]

TABLE C1-13

SPECIMEN NUMBER:
ALLOY:
ORIENTATION:
CONSTRAINT:
TEST TEMPERATURE:
SPECIMEN THICKNESS:
K (MAX) DURING PRECRACKING:

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63-314
2024-Y861
TRANSVERSE
STIFFNESS
294.0 K
1.63 MM (.064 IN)
20.73 MPA SQRT(M) ( 18.87 KSI SQRT(IN))

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LOAD		COD		A. HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		FULL SECTION		STRESS NET SECTION			
KN	KIPS	E-3 MM	E-3 IN	MM	IN	MM	IN	MPA	SQRT (N)	KSI	SQRT (IN)	MPA	KSI	MPA	KSI
0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.0	0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0	0.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0	0.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0	1.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.0	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7.0	1.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8.0	1.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9.0	2.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.0	2.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11.0	2.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12.0	2.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13.0	3.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14.0	3.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15.0	3.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16.0	3.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17.0	4.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18.0	4.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19.0	4.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20.0	5.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21.0	5.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22.0	5.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23.0	6.0	0.00	0.00	0.00</											

TABLE C1-15

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63-ET1
2024-T861
TRANSVERSE
STIFFENED
294.1 K
1.54 MM (.065 IN)
24.03 MPA SORT(M) ( 21.87 KSI SORT(IN))

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LOAD		COJ		A HALF CRACK LENGTH		DELTA A		STRESS		INTENSITY		STRESS	
KN	KIPS	E-3 MM	E-3 IN	MM	IN	MM	IN	MPA	SQRT (M)	KSI	SQRT (IN)	MPA	KSI
0.0	0.0	3.4	0.13	21.64	.853	0.00	0.000	8.00	0.00	1.00	0.00	1.00	0.00
15.0	3.4	3.4	1.56	21.73	.859	.11	.004	8.14	7.45	1.00	0.00	1.00	0.00
80.1	18.4	223.3	8.79	22.15	.868	.37	.015	48.68	39.75	163.74	2.37	192.00	2.37
80.1	18.4	235.5	9.27	23.24	.913	1.52	.060	48.84	40.80	163.62	2.34	193.80	2.34
81.3	18.4	241.7	9.56	23.23	.915	1.55	.061	45.82	41.70	167.08	2.33	197.96	2.33
82.7	18.4	255.5	10.05	23.67	.934	2.54	.100	47.37	43.11	168.95	2.34	201.74	2.34
83.8	18.4	275.5	10.86	23.67	1.011	3.99	.157	49.54	45.18	171.26	2.34	206.93	2.34
86.0	19.3	287.5	11.32	25.98	1.023	4.30	.169	51.14	46.54	175.66	2.35	212.78	2.35
86.6	19.4	326.6	12.87	27.45	1.081	5.77	.227	52.93	48.17	176.48	2.35	216.36	2.35

TABLE C1-15

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63-3T9
2024-T861
TRANSVERSE
STIFFENED
294.0 K
1.63 MM (.064 IN)
23.29 MPA SQRT(M) ( 21.01 KSI SQRT(IN))

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[illegible]

SPECIMEN NUMBER: 63-5T11
 ALLOY: 2024-T861
 ORIENTATION: TRANSVERSE
 CONSTRAINT: STIFFENED
 TEST TEMPERATURE: 450.0 K
 SPECIMEN THICKNESS: 1.67 MM (.066 IN)
 K (MAX) DURING PNE CRACKING: 37.70 MPA SQRT(M) (34.31 KSI SQRT(IN))

LOAD		COR		A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS	
KN	KIPS	E-3 MM	E-3 IN	MM	IN	MM	IN	MPA	SQRT (H)	KSI	SQRT (IN)
55.6	12.5	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
60.6	13.6	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
65.6	14.7	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
70.6	15.8	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
75.6	16.9	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
80.6	18.0	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
85.6	19.1	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
90.6	20.2	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
95.6	21.3	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
100.6	22.4	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
105.6	23.5	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
110.6	24.6	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
115.6	25.7	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
120.6	26.8	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
125.6	27.9	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
130.6	29.0	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
135.6	30.1	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
140.6	31.2	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
145.6	32.3	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
150.6	33.4	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
155.6	34.5	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
160.6	35.6	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
165.6	36.7	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
170.6	37.8	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
175.6	38.9	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
180.6	40.0	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
185.6	41.1	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
190.6	42.2	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
195.6	43.3	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
200.6	44.4	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
205.6	45.5	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
210.6	46.6	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
215.6	47.7	31.7	2.0	49.2	1.937	0.43	0.017	30.80	36.00	6.00	0.60
220.6	48.8	31.7	2.0	49.2							

SPECIMEN NUMBER: 63-6T9
 ALLOY: 2024-T861
 ORIENTATION: TRANSVERSE
 CONSTRAINT: STIFFENED
 TEST TEMPERATURE: 450.0 K
 SPECIMEN THICKNESS: 1.64 MM (.065 IN)
 < (MAX) DURING PRECRACKING: 29.45 MPA SQRT () (35.62 KSI SQRT (IN))

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TABLE C1-18

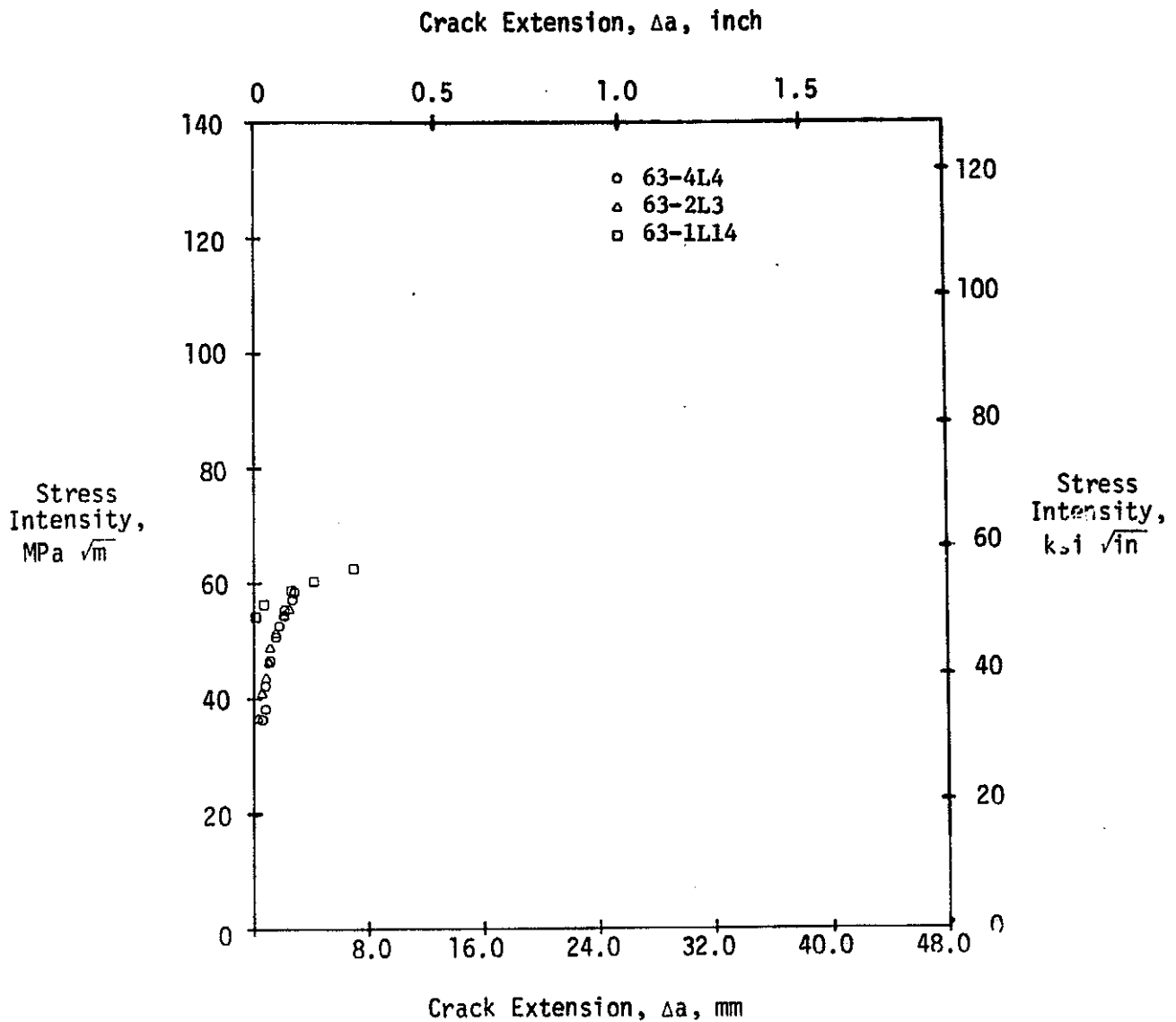
SPECIMEN NUMBER: 63-7T2
ALLOY: 2024-T861
ORIENTATION: TRANSVERSE
CONSTRAINT: STIFFENED
TEST TEMPERATURE: 450 J K
SPECIMEN THICKNESS: 1.66 MM (.065 IN)
K (MAX) DURING PRECRACKING: 27.11 MPA SQRT (H) (24.67 KSI SQRT (IN))

KN	LOAD KIPS	COD E-3 MM	COD E-3 IN	A, HALF CRACK LENGTH MM	A, HALF CRACK LENGTH IN	DELTA A MM	DELTA A IN	MPA STRESS SQRT (H)	KSI INTENSITY SQRT (IN)	FULL SECTION MPA	STRESS KSI	NET SECTION MPA	STRESS KSI
0	0	0	0	46.81	1.846	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00
5	5	2	0.08	41.14	1.620	0.34	0.013	4.50	4.79	1.00	1.00	0.00	0.00
10	10	4	0.16	41.85	1.649	1.15	0.045	4.50	4.79	1.00	1.00	0.00	0.00
15	15	6	0.24	42.97	1.692	2.16	0.085	4.50	4.79	1.00	1.00	0.00	0.00
20	20	8	0.32	44.33	1.745	3.50	0.139	4.50	4.79	1.00	1.00	0.00	0.00
25	25	10	0.40	45.33	1.800	5.13	0.202	4.50	4.79	1.00	1.00	0.00	0.00
30	30	12	0.48	46.17	1.851	7.48	0.294	4.50	4.79	1.00	1.00	0.00	0.00
35	35	14	0.56	46.99	1.885	9.63	0.378	4.50	4.79	1.00	1.00	0.00	0.00
40	40	16	0.64	47.71	1.951	11.83	0.516	4.50	4.79	1.00	1.00	0.00	0.00
45	45	18	0.72	48.33	1.985	13.88	0.733	4.50	4.79	1.00	1.00	0.00	0.00
50	50	20	0.80	48.99	1.985	15.83	0.938	4.50	4.79	1.00	1.00	0.00	0.00
55	55	22	0.88	49.67	1.956	17.74	1.137	4.50	4.79	1.00	1.00	0.00	0.00
60	60	24	0.96	50.33	1.985	19.63	1.350	4.50	4.79	1.00	1.00	0.00	0.00
65	65	26	1.04	50.99	1.985	21.43	1.474	4.50	4.79	1.00	1.00	0.00	0.00
70	70	28	1.12	51.67	2.033	23.17	1.570	4.50	4.79	1.00	1.00	0.00	0.00
75	75	30	1.20	52.33	2.066	24.83	1.663	4.50	4.79	1.00	1.00	0.00	0.00
80	80	32	1.28	53.00	2.086	26.43	1.700	4.50	4.79	1.00	1.00	0.00	0.00
85	85	34	1.36	53.67	2.127	27.93	1.725	4.50	4.79	1.00	1.00	0.00	0.00
90	90	36	1.44	54.33	2.151	29.33	1.745	4.50	4.79	1.00	1.00	0.00	0.00
95	95	38	1.52	54.99	2.185	30.63	1.751	4.50	4.79	1.00	1.00	0.00	0.00
100	100	40	1.60	55.67	2.209	31.83	1.752	4.50	4.79	1.00	1.00	0.00	0.00
105	105	42	1.68	56.33	2.233	32.93	1.755	4.50	4.79	1.00	1.00	0.00	0.00
110	110	44	1.76	56.99	2.257	33.93	1.755	4.50	4.79	1.00	1.00	0.00	0.00
115	115	46	1.84	57.67	2.281	34.83	1.755	4.50	4.79	1.00	1.00	0.00	0.00
120	120	48	1.92	58.33	2.305	35.63	1.755	4.50	4.79	1.00	1.00	0.00	0.00
125	125	50	2.00	58.99	2.329	36.33	1.755	4.50	4.79	1.00	1.00	0.00	0.00
130	130	52	2.08	59.67	2.353	36.93	1.755	4.50	4.79	1.00	1.00	0.00	0.00
135	135	54	2.16	60.33	2.377	37.43	1.755	4.50	4.79	1.00	1.00	0.00	0.00
140	140	56	2.24	60.99	2.401	37.93	1.755	4.50	4.79	1.00	1.00	0.00	0.00
145	145	58	2.32	61.67	2.425	38.33	1.755	4.50	4.79	1.00	1.00	0.00	0.00
150	150	60	2.40	62.33	2.449	38.73	1.755	4.50	4.79	1.00	1.00	0.00	0.00
155	155	62	2.48	62.99	2.473	39.13	1.755	4.50	4.79	1.00	1.00	0.00	0.00
160	160	64	2.56	63.67	2.497	39.53	1.755	4.50	4.79	1.00	1.00	0.00	0.00
165	165	66	2.64	64.33	2.521	39.93	1.755	4.50	4.79	1.00	1.00	0.00	0.00
170	170	68	2.72	64.99	2.545	40.33	1.755	4.50	4.79	1.00	1.00	0.00	0.00
175	175	70	2.80	65.67	2.569	40.73	1.755	4.50	4.79	1.00	1.00	0.00	0.00
180	180	72	2.88	66.33	2.593	41.13	1.755	4.50	4.79	1.00	1.00	0.00	0.00
185	185	74	2.96	66.99	2.617	41.53	1.755	4.50	4.79	1.00	1.00	0.00	0.00
190	190	76	3.04	67.67	2.641	41.93	1.755	4.50	4.79	1.00	1.00	0.00	0.00
195	195	78	3.12	68.33	2.665	42.33	1.755	4.50	4.79	1.00	1.00	0.00	0.00
200	200	80	3.20	68.99	2.689	42.73	1.755	4.50	4.79	1.00	1.00	0.00	0.00
205	205	82	3.28	69.67	2.713	43.13	1.755	4.50	4.79	1.00	1.00	0.00	0.00
210	210	84	3.36	70.33	2.737	43.53	1.755	4.50	4.79	1.00	1.00	0.00	0.00
215	215	86	3.44	70.99	2.761	43.93	1.755	4.50	4.79	1.00	1.00	0.00	0.00
220	220	88	3.52	71.67	2.785	44.33	1.755	4.50	4.79	1.00	1.00	0.00	0.00
225	225	90	3.60	72.33	2.809	44.73	1.755	4.50	4.79	1.00	1.00	0.00	0.00
230	230	92	3.68	72.99	2.833	45.13	1.755	4.50	4.79	1.00	1.00	0.00	0.00
235	235	94	3.76	73.67	2.857	45.53	1.755	4.50	4.79	1.00	1.00	0.00	0.00
240	240	96	3.84	74.33	2.881	45.93	1.755	4.50	4.79	1.00	1.00	0.00	0.00
245	245	98	3.92	74.99	2.905	46.33	1.755	4.50	4.79	1.00	1.00	0.00	0.00
250	250	100	4.00	75.67	2.929	46.73	1.755	4.50	4.79	1.00	1.00	0.00	0.00
255	255	102	4.08	76.33	2.953	47.13	1.755	4.50	4.79	1.00	1.00	0.00	0.00
260	260	104	4.16	76.99	2.977	47.53	1.755	4.50	4.79	1.00	1.00	0.00	0.00
265	265	106	4.24	77.67	2.999	47.93	1.755	4.50	4.79	1.00	1.00	0.00	0.00
270	270	108	4.32	78.33	3.023	48.33	1.755	4.50	4.79	1.00	1.00	0.00	0.00
275	275	110	4.40	78.99	3.047	48.73	1.755	4.50	4.79	1.00	1.00	0.00	0.00
280	280	112	4.48	79.67	3.071	49.13	1.755	4.50	4.79	1.00	1.00	0.00	0.00
285	285	114	4.56	80.33	3.095	49.53	1.755	4.50	4.79	1.00	1.00	0.00	0.00
290	290	116	4.64	80.99	3.119	49.93	1.755	4.50	4.79	1.00	1.00	0.00	0.00
295	295	118	4.72	81.67	3.143	50.33	1.755	4.50	4.79	1.00	1.00	0.00	0.00
300	300	120	4.80	82.33	3.167	50.73	1.755	4.50	4.79	1.00	1.00	0.00	0.00
305	305	122	4.88	82.99	3.191	51.13	1.755	4.50	4.79	1.00	1.00	0.00	0.00
310	310	124	4.96	83.67	3.215	51.53	1.755	4.50	4.79	1.00	1.00	0.00	0.00
315	315	126	5.04	84.33	3.239	51.93	1.755	4.50	4.79	1.00	1.00	0.00	0.00
320	320	128	5.12	84.99	3.263	52.33	1.755	4.50	4.79	1.00	1.00	0.00	0.00
325	325	130	5.20	85.67	3.287	52.73	1.755	4.50	4.79	1.00	1.00	0.00	0.00
330	330	132	5.28	86.33	3.311	53.13	1.755	4.50	4.79	1.00	1.00	0.00	0.00
335	335	134	5.36	86.99	3.335	53.53	1.755	4.50	4.79	1.00	1.00	0.00	0.00
340	340	136	5.44	87.67	3.359	53.93	1.755	4.50	4.79	1.00	1.00	0.00	0.00
345	345	138	5.52	88.33	3.383	54.33	1.755	4.50	4.79	1.00	1.00	0.00	0.00
350	350	140	5.60	88.99	3.407	54.73	1.755	4.50	4.79	1.00	1.00	0.00	0.00
355	355	142	5.68	89.67	3.431	55.13	1.755	4.50	4.79	1.00	1.00	0.00	0.00
360	360	144	5.76	90.33	3.455	55.53	1.755	4.50	4.79	1.00	1.00	0.00	0.00
365	365	146	5.84	90.99	3.479	55.93	1.755	4.50	4.79	1.00	1.00	0.00	0.00
370	370	148	5.92	91.67	3.503	56.33	1.755	4.50	4.79	1.00	1.00	0.00	0.00
375	375	150	6.00	92.33	3.527	56.73	1.755	4.50	4.79	1.00	1.00	0.00	0.00
380	380	152	6.08	92.99	3.551	57.13	1.755	4.50	4.79	1.00	1.00	0.00	0.00
385	385	154	6.16	93.67	3.575	57.53	1.755	4.50	4.79	1.00	1.00	0.00	0.00
390	390	156	6.24	94.33	3.599	57.93	1.755	4.50	4.79	1.00	1.00	0.00	0.00
395	395	158	6.32	94.99	3.623	58.33	1.755	4.50	4.79	1.00	1.00	0.00	0.00
400	400	160	6.40	95.67	3.647	58.73	1.755	4.50	4.79	1.00	1.00	0.00	0.00
405	405	162	6.48	96.33	3.671	59.13	1.755	4.50	4.79	1.00	1.00	0.00	0.00
410	410	164	6.56	96.99	3.695	59.53	1.755	4.50	4.79	1.00	1.00	0.00	0.00
415	415	166	6.64	97.67	3.719	59.93	1.755	4.50	4.79	1.00	1.00	0.00	0.00
420	420	168	6.72	98.33	3.743	60.33	1.755	4.50	4.79	1.00	1.00	0.00	0.00
425	425	170	6.80	98.99	3.767	60.73	1.755	4.50	4.79	1.00	1.00	0.00	0.00
430	430	172	6.88	99.67	3.791	61.13	1.755	4.50	4.79	1.00	1.00	0.00	0.00
435	435	174	6.96	100.33	3.815	61.53	1.755	4.50	4.79	1.00	1.00	0.00	0.00
440	440	176	7.04	100.99	3.839	6							

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 1.60 mm (.063 inch)

Orientation: Longitudinal

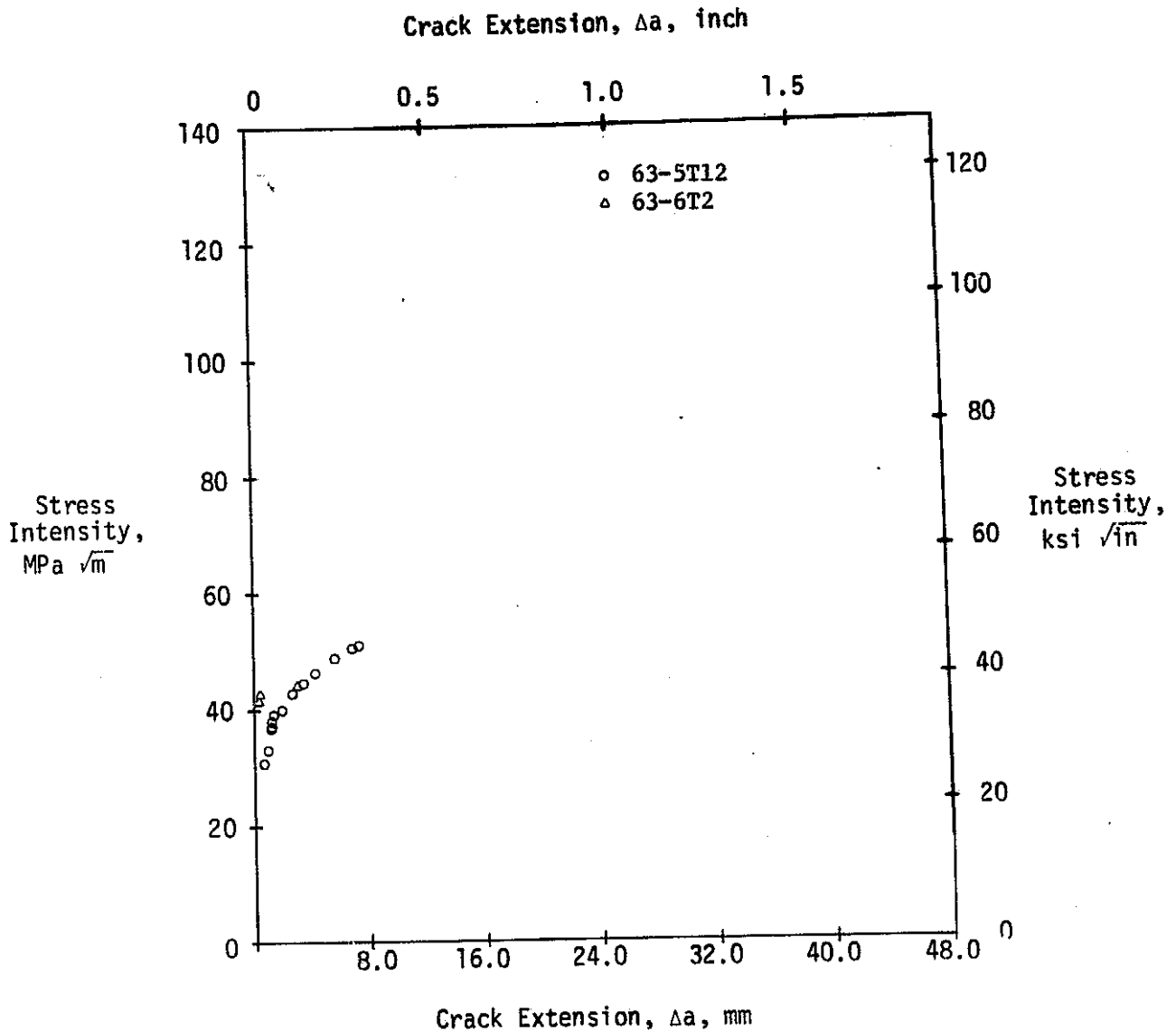
Temperature: 144°K (-200°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

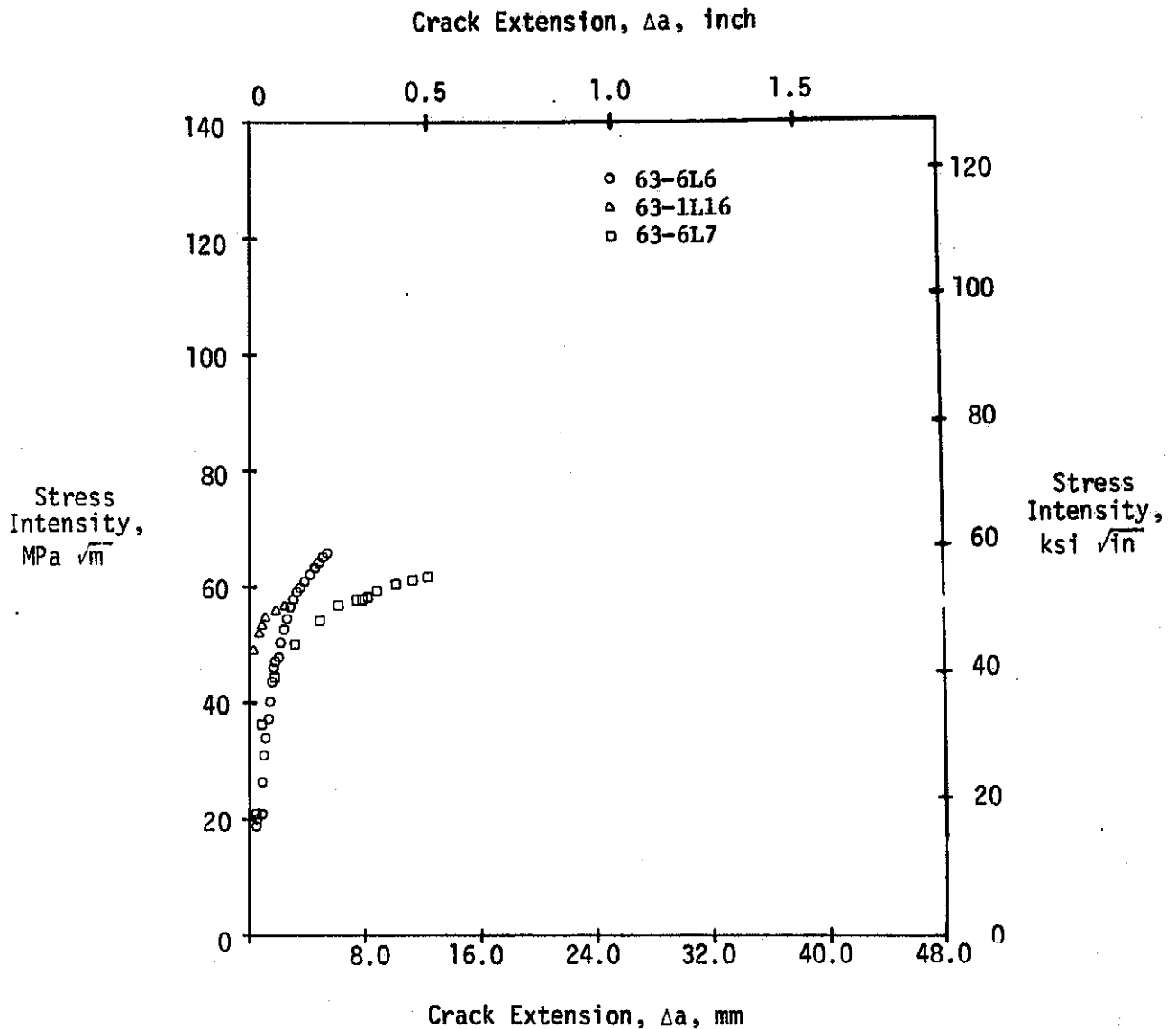
MDC E1153
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FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 1.60 mm (.063 inch)

Orientation: Longitudinal

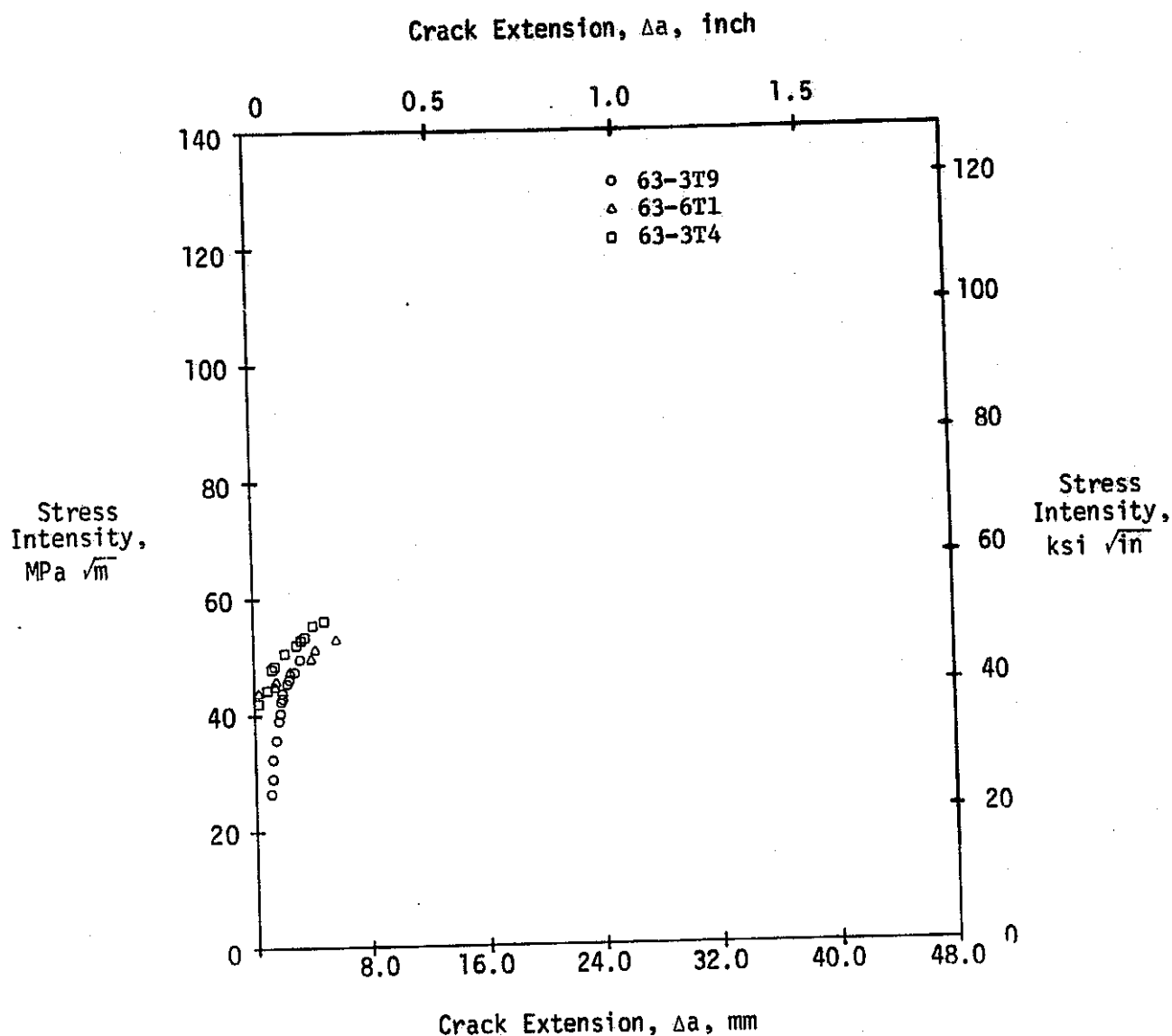
Temperature: 298°K (70°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
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Thickness: 1.60 mm (.063 inch)

Orientation: Transverse

Temperature: 298°K (70°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

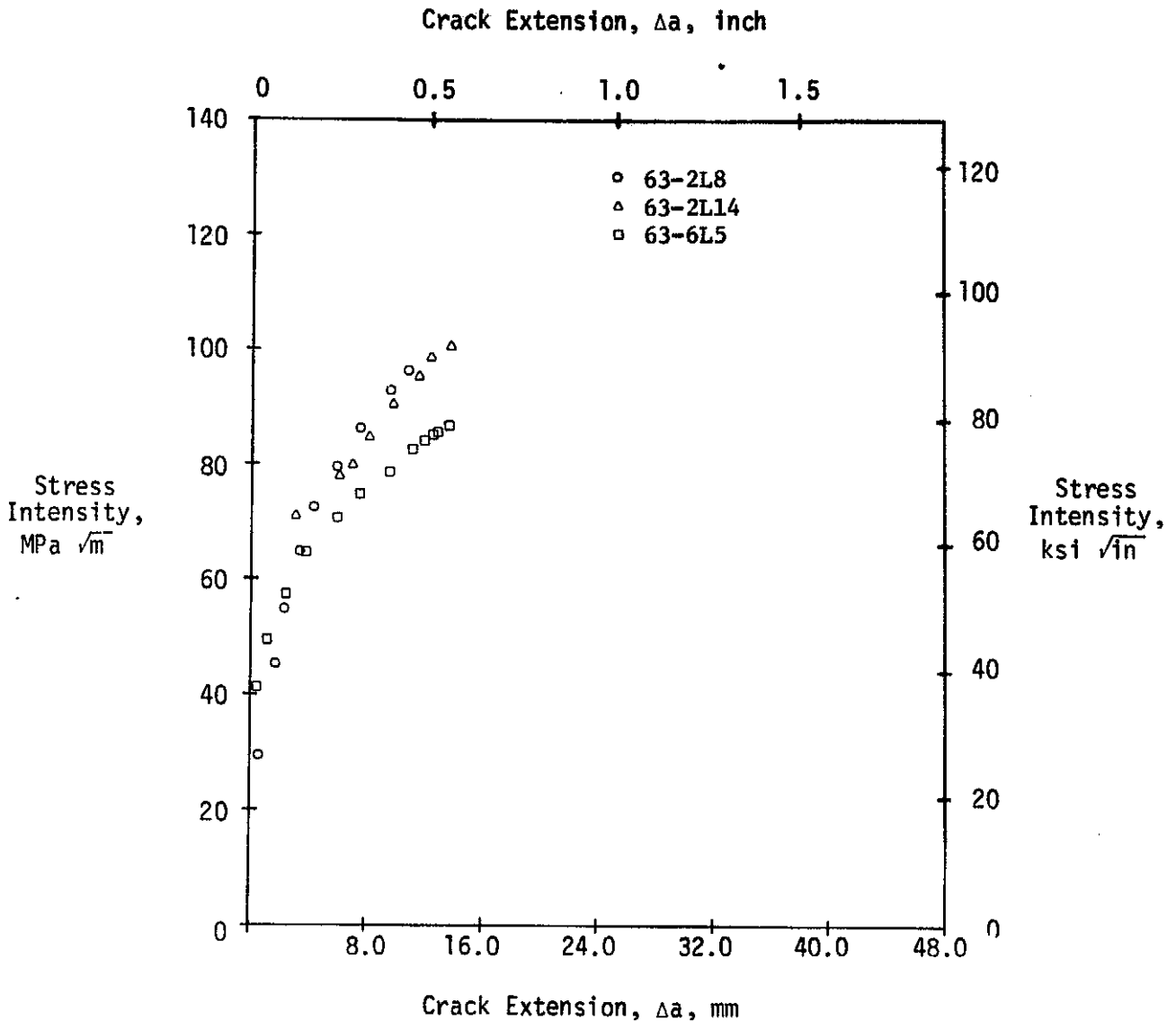
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FIGURE C1-4

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FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

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Thickness: 1.60 mm (.063 inch)

Orientation: Longitudinal

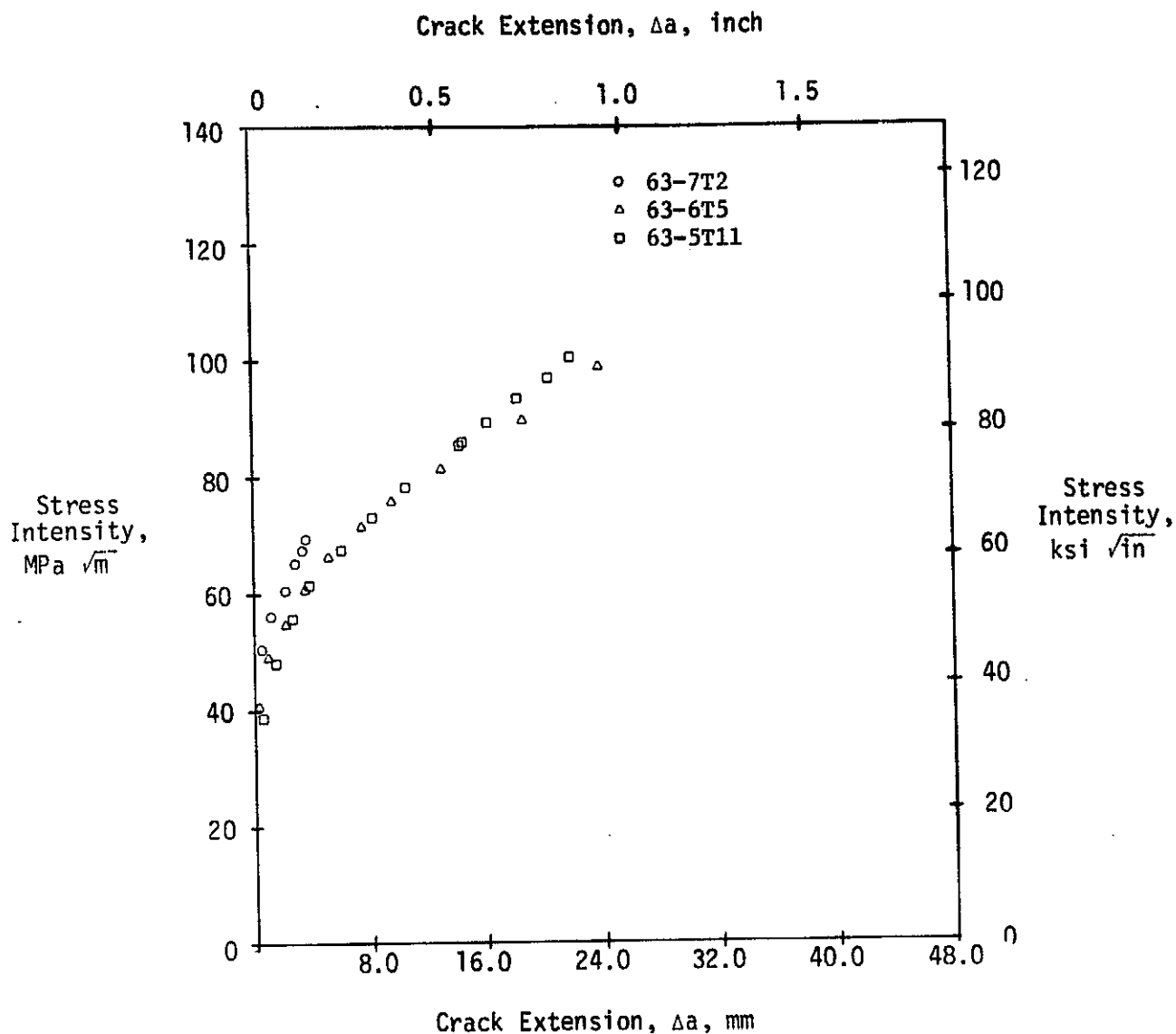
Temperature: 450°K (350°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

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FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

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Thickness: 1.60 mm (.063 inch)

Orientation: Transverse

Temperature: 450°K (350°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

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FRACTURE MECHANICS DATA FOR
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SECTION C2. FRACTURE TOUGHNESS TEST DATA FOR 1.60 mm
(.063 INCH) THICK 2024-T861, BUCKLING UNRESTRAINED

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TABLE C2-1.

Fracture Toughness Test Data for 2024-T861 Specimens
(1.60 mm (.063 inch) Thick, Buckling Unrestrained)

Specimen Number	Tempera- ture (K)	Orien- tation	Specimen		Dimensions		Precrack		Precrack		Failure		Full Section		Critical Intensity, MPa√m	Stress Intensity, K _c ksi√in	Data Table No.	Figure No.
			Thickness mm	in	Width cm	in	Length mm	in	Load kN	kip	Load kN	kip	Failure MPa	Stress ksi				
U63-1L3	144	L	1.65	.0563	29.789	11.728	24.71	.97	53.4	12.0	120.8	27.1	244.5	35.5	62.6	57.0	C2-2	C2-1
U63-2L11	144	L	1.63	.0643	29.797	11.731	12.19	.48	75.6	17.0	161.2	36.3	331.4	46.1	58.6	53.3	C2-3	C2-1
													AVG:	60.6	55.2			
U63-5L2	294	L	1.66	.0653	29.794	11.730	82.75	3.26	26.7	6.0	69.7	15.7	141.2	20.5	*	60.7	C2-4	C2-2
U63-1L2	294	L	1.63	.0641	29.812	11.737	43.89	1.73	40.0	9.0	112.5	25.3	231.9	33.6	66.7	60.7	C2-5	C2-2
U63-7L4	294	L	1.64	.0646	29.799	11.732	12.42	.49	75.6	17.0	166.4	37.4	340.3	49.3	**	60.7	**	**
													AVG:	66.7	60.7			
U63-6L2	450	L	1.64	.0644	29.784	11.726	98.88	3.89	44.5	10.0	91.4	20.5	187.7	27.2	97.9	89.1	C2-6	C2-4
U63-1L12	450	L	1.65	.0648	29.789	11.728	81.81	3.22	48.9	11.0	106.5	24.0	217.3	31.5	+		C2-7	C2-4
U63-3L2	450	L	1.64	.0644	29.809	11.736	61.93	2.44	48.9	11.0	121.0	27.2	248.2	36.0	+	89.1	C2-8	C2-4
													AVG:	97.9	89.1			
U63-5T1	144	T	1.66	.0653	29.794	11.730	90.35	3.56	22.2	5.0	52.5	11.8	106.2	15.4	**		**	**
U63-2T2	144	T	1.64	.0647	29.799	11.732	25.22	.99	44.5	10.0	99.2	22.3	202.6	29.4	**		**	**
U63-4T10	144	T	1.65	.0650	29.784	11.726	10.13	.40	66.7	15.0	152.8	34.3	310.8	45.1	**		**	**
U63-6T7	294	T	1.64	.0646	29.815	11.738	80.34	3.16	26.7	6.0	62.7	14.1	128.2	18.6	51.1	46.5	C2-9	C2-3
U63-2T1	294	T	1.65	.0648	29.799	11.732	43.21	1.70	35.6	8.0	91.2	20.5	185.9	27.0	**		**	**
U63-1T2	294	T	1.63	.0643	29.761	11.717	++		++		++		++		++		++	++
													AVG:	51.1	46.5			
U63-7T1	450	T	1.65	.0561	29.804	11.734	94.69	3.73	35.6	8.0	86.5	19.5	175.6	25.5	**		**	**
U63-6T9	450	T	1.65	.0650	29.820	11.740	83.24	3.28	48.9	11.0	97.4	21.9	197.9	28.7	+		C2-10	C2-5
U63-4T5	450	T	1.66	.0655	29.799	11.732	60.48	2.38	53.4	12.0	116.1	26.1	234.2	34.0	+		C2-11	C2-5

* Film ran out prior to failure.

** No crack extension measurable due to poor resolution on 16mm film.

+ Crack resolution near instability lost due to excessive buckling out of the focal plane of the movie camera.

++ Specimen failed in the grips.

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TABLE C2-2

SPECIMEN NUMBER: U63-1L3
ALLOY: 2024-T861
ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 144.1 K
SPECIMEN THICKNESS: 1.66 MM (.065 IN)
K (MAX) DURING PRECRACKING: 21.38 MPA SQRT(M) (19.45 KSI SQRT(IN))

LOAD KN	LOAD KIPS	A, HALF CRACK LENGTH		DELTA A		MPA	STRESS SQRT(M)	INTENSITY KSI SQRT(IN)	STRESS		STRESS	
		MM	IN	MM	IN				FULL SECTION MPA	KSI	NET SECTION MPA	KSI
94.7	21.3	12.36	.496	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00
112.5	25.3	15.76	.622	1.48	.058	40.08	36.48	36.48	191.79	27.81	211.31	30.64
119.7	26.9	18.02	.710	3.37	.133	58.94	46.40	46.40	227.81	33.04	254.73	36.04
121.5	27.3	22.35	.881	5.66	.223	58.15	52.93	52.93	242.21	35.13	275.59	39.09
				9.99	.393	55.95	59.65	59.65	244.61	35.39	297.09	41.63

TABLE C2-3

SPECIMEN NUMBER: U63-2L11
ALLOY: 2024-T861
ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 144.1 K
SPECIMEN THICKNESS: 1.63 MM (.064 IN)
K (MAX) DURING PRECRACKING: 21.53 MPA SQRT(M) (19.59 KSI SQRT(IN))

LOAD KN	LOAD KIPS	A, HALF CRACK LENGTH		DELTA A		MPA	STRESS SQRT(M)	INTENSITY KSI SQRT(IN)	STRESS		STRESS	
		MM	IN	MM	IN				FULL SECTION MPA	KSI	NET SECTION MPA	KSI
0.0	0.0	6.11	.240	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00
138.8	30.9	6.37	.251	0.73	.029	34.94	31.79	31.79	268.77	38.98	278.82	40.43
149.9	33.4	7.85	.310	0.76	.030	45.12	41.26	41.26	317.17	45.54	321.97	46.69
156.6	35.0	7.82	.308	1.73	.068	53.53	45.98	45.98	321.79	46.67	339.63	49.25
159.7	35.9	8.20	.323	2.11	.083	52.79	48.93	48.93	328.19	47.59	347.32	50.37
161.1	36.0	11.71	.461	5.62	.221	63.37	57.67	57.67	329.11	47.73	357.19	51.80

TABLE C2-4

SPECIMEN NUMBER: U63-5L2
ALLOY: 2024-T861
ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 294.2 K
SPECIMEN THICKNESS: 1.66 MM (.065 IN)
K (MAX) DURING PRECRACKING: 20.45 MPA SQRT (M) (18.61 KSI SQRT (IN))

KN	LOAD KIPS	A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS		STRESS	
		MM	IN	MM	IN	MPA SQRT (M)	KSI SQRT (IN)	FULL SECTION MPA	KSI	NET SECTION MPA	KSI
0.0	0.0	41.38	1.629	0.02	0.000	0.00	0.00	0.00	0.00	0.00	0.00
54.7	12.5	41.81	1.646	.44	.017	42.22	38.45	113.73	16.06	153.94	22.32
61.4	13.8	42.92	1.691	1.55	.061	48.10	43.77	124.24	18.02	174.52	25.31

TABLE C2-5

SPECIMEN NUMBER: U63-1L2
ALLOY: 2024-T861
ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 294.2 K
SPECIMEN THICKNESS: 1.63 MM (.064 IN)
K (MAX) DURING PRECRACKING: 21.95 MPA SQRT (M) (19.98 KSI SQRT (IN))

KN	LOAD KIPS	A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS		STRESS	
		MM	IN	MM	IN	MPA SQRT (M)	KSI SQRT (IN)	FULL SECTION MPA	KSI	NET SECTION MPA	KSI
0.0	0.0	21.95	.864	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00
8.0	1.8	22.13	.871	.18	.007	32.83	29.87	122.82	17.81	144.23	20.92
16.0	3.6	22.42	.883	.43	.017	46.55	42.46	160.97	24.50	201.13	28.96
24.0	5.4	24.24	.946	1.00	.040	57.75	48.91	192.48	27.91	229.44	32.85
110.8	24.9	35.57	1.007	3.63	.143	65.84	59.85	228.23	33.10	275.49	39.54
111.7	25.1	35.73	1.016	4.85	.192	66.72	60.72	233.06	33.36	278.22	39.74

TABLE C2-6

SPECIMEN NUMBER: U63-6L2
ALLOY: 2024-T861
ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 450.0 K
SPECIMEN THICKNESS: 1.64 MM (.064 IN)
K (MAX) DURING PRECRACKING: 38.64 MPA SQRT(M) (35.17 KSI SQRT(IN))

KN	LOAD KIPS	A, HALF CRACK LENGTH MM	IN	DELTA A MM	IN	STRESS INTENSITY MPA SQRT(M)	KSI SQRT(IN)	FULL SECTION MPA	KSI	STRESS NET SECTION MPA	KSI
10000	2.25	49.44	1.946	1.11	0.043	1.11	0.043	1.11	0.043	1.11	0.043
10000	2.25	50.00	1.969	1.11	0.043	1.11	0.043	1.11	0.043	1.11	0.043
10000	2.25	50.00	1.969	1.11	0.043	1.11	0.043	1.11	0.043	1.11	0.043
10000	2.25	50.00	1.969	1.11	0.043	1.11	0.043	1.11	0.043	1.11	0.043
10000	2.25	50.00	1.969	1.11	0.043	1.11	0.043	1.11	0.043	1.11	0.043
10000	2.25	50.00	1.969	1.11	0.043	1.11	0.043	1.11	0.043	1.11	0.043
10000	2.25	50.00	1.969	1.11	0.043	1.11	0.043	1.11	0.043	1.11	0.043
10000	2.25	50.00	1.969	1.11	0.043	1.11	0.043	1.11	0.043	1.11	0.043
10000	2.25	50.00	1.969	1.11	0.043	1.11	0.043	1.11	0.043	1.11	0.043
10000	2.25	50.00	1.969	1.11	0.043	1.11	0.043	1.11	0.043	1.11	0.043

TABLE C2-7

SPECIMEN NUMBER: U63-1L12
ALLOY: 2024-T861
ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 450.0 K
SPECIMEN THICKNESS: 1.65 MM (.065 IN)
K (MAX) DURING PRECRACKING: 37.54 MPA SQRT(M) (34.16 KSI SQRT(IN))

KN	LOAD KIPS	A, HALF CRACK LENGTH MM	IN	DELTA A MM	IN	STRESS INTENSITY MPA SQRT(M)	KSI SQRT(IN)	FULL SECTION MPA	KSI	STRESS NET SECTION MPA	KSI
10000	2.25	41.91	1.651	1.11	0.043	1.11	0.043	1.11	0.043	1.11	0.043
10000	2.25	41.91	1.651	1.11	0.043	1.11	0.043	1.11	0.043	1.11	0.043
10000	2.25	41.91	1.651	1.11	0.043	1.11	0.043	1.11	0.043	1.11	0.043
10000	2.25	41.91	1.651	1.11	0.043	1.11	0.043	1.11	0.043	1.11	0.043
10000	2.25	41.91	1.651	1.11	0.043	1.11	0.043	1.11	0.043	1.11	0.043
10000	2.25	41.91	1.651	1.11	0.043	1.11	0.043	1.11	0.043	1.11	0.043
10000	2.25	41.91	1.651	1.11	0.043	1.11	0.043	1.11	0.043	1.11	0.043
10000	2.25	41.91	1.651	1.11	0.043	1.11	0.043	1.11	0.043	1.11	0.043
10000	2.25	41.91	1.651	1.11	0.043	1.11	0.043	1.11	0.043	1.11	0.043
10000	2.25	41.91	1.651	1.11	0.043	1.11	0.043	1.11	0.043	1.11	0.043

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TABLE C2-8

SPECIMEN NUMBER: U63-3L2
 ALLOY: 2024-T861
 ORIENTATION: LONGITUDINAL
 CONSTRAINT: UNSTIFFENED
 TEST TEMPERATURE: 450.0 K
 SPECIMEN THICKNESS: 1.54 MM (0.064 IN)
 K (MAX) DURING PRECRACKING: 32.16 MPA SORT (M) (29.25 KSI SORT (IN))

LOAD		A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS		STRESS	
KN	KIPS	MM	IN	MM	IN	MPA SORT (M)	KSI SORT (IN)	MPA	KSI	MPA	KSI
0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
1.0	0.2	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
61.0	13.8	0.0	0.0	0.0	0.0	7.68	6.99	23.72	3.44	30.10	4.96
61.0	13.8	0.0	0.0	0.0	0.0	41.17	37.47	126.82	18.39	161.00	23.36
61.0	13.8	0.0	0.0	0.0	0.0	59.38	54.04	177.00	25.67	228.54	33.14
105.4	23.7	0.0	0.0	0.0	0.0	75.54	68.75	217.23	1.36	285.30	41.37
114.3	25.7	0.0	0.0	0.0	0.0	85.60	78.81	234.4	34.00	310.97	46.34

TABLE C2-9

SPECIMEN NUMBER: U63-ET7
 ALLOY: 2024-T861
 ORIENTATION: TRANSVERSE
 CONSTRAINT: UNSTIFFENED
 TEST TEMPERATURE: 294.0 K
 SPECIMEN THICKNESS: 1.54 MM (0.065 IN)
 K (MAX) DURING PRECRACKING: 20.30 MPA SORT (M) (18.47 KSI SORT (IN))

LOAD		A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS		STRESS	
KN	KIPS	MM	IN	MM	IN	MPA SORT (M)	KSI SORT (IN)	MPA	KSI	MPA	KSI
0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
61.0	13.8	0.0	0.0	0.0	0.0	45.92	42.70	126.50	18.23	172.33	24.99
61.0	13.8	0.0	0.0	0.0	0.0	52.12	47.63	126.41	18.33	189.52	26.90

TABLE C2-10

SPECIMEN NUMBER: U63-6T9
ALLOY: 2024-T861
ORIENTATION: TRANSVERSE
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 450.1 K
SPECIMEN THICKNESS: 1.65 MM (.065 IN)
K(MAX) DURING PRECRACKING: 37.77 MPA SQRT(M) (34.37 KSI SQRT(IN))

LOAD		A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS		STRESS	
KN	KIPS	MM	IN	MM	IN	MPA SQRT(M)	KSI SQRT(IN)	FULL SECTION MPA	KSI	NET SECTION MPA	KSI
0.0	0.0	44.60	1.638	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00
58.0	13.0	44.60	1.638	-1.44	-0.057	51.77	47.12	139.16	20.18	193.51	27.63
84.0	19.0	44.60	1.638	.4	.016	55.61	50.71	171.69	24.91	239.07	34.67
97.0	22.0	44.60	1.638	2.05	.080	69.27	63.04	177.12	25.68	250.42	36.32
94.0	21.0	44.60	1.638	3.73	.147	68.39	62.24	170.79	24.77	245.47	35.59

TABLE C2-11

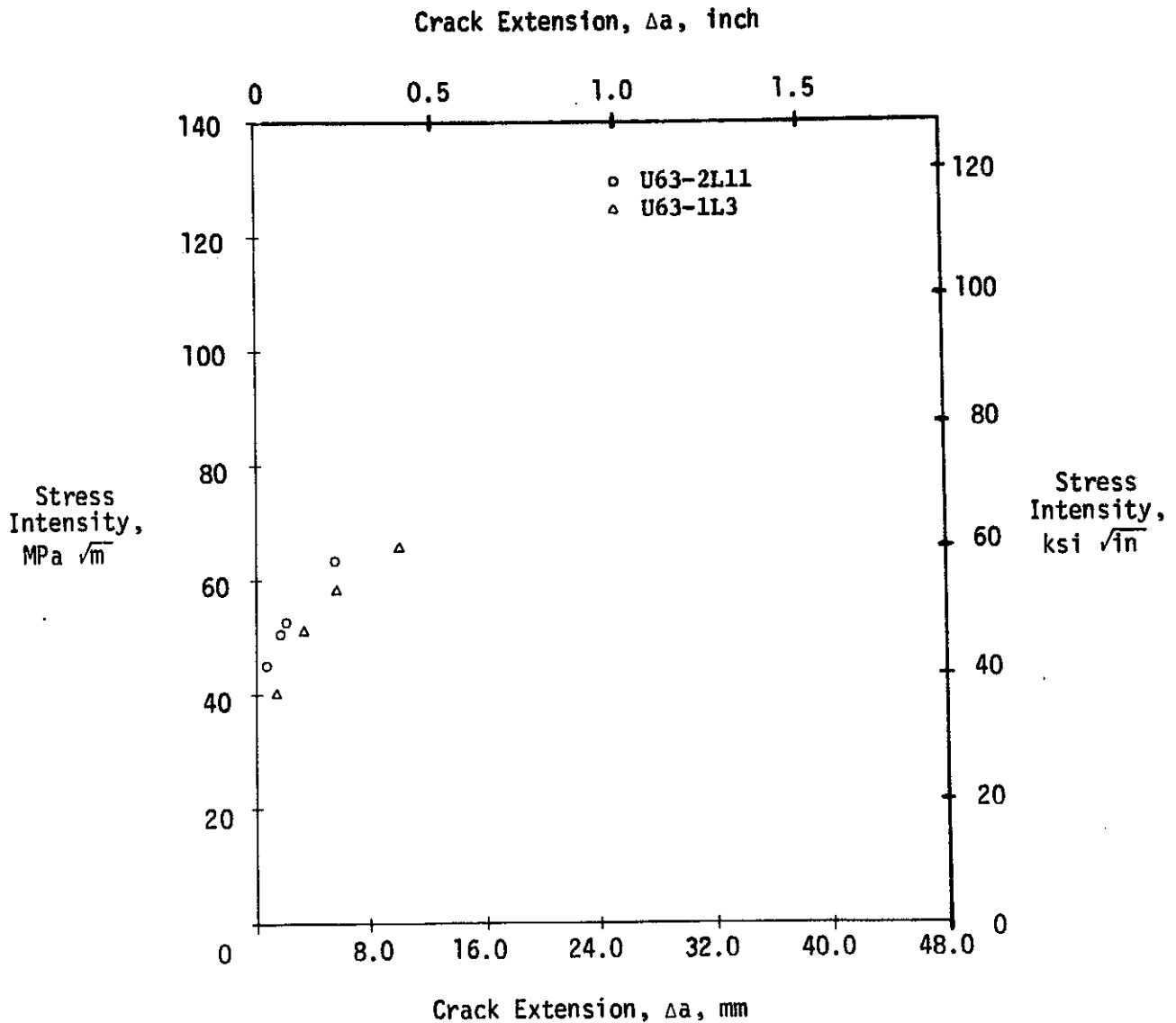
SPECIMEN NUMBER: U63-4T5
ALLOY: 2024-T861
ORIENTATION: TRANSVERSE
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 450.1 K
SPECIMEN THICKNESS: 1.65 MM (.065 IN)
K(MAX) DURING PRECRACKING: 34.05 MPA SQRT(M) (30.99 KSI SQRT(IN))

LOAD		A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS		STRESS	
KN	KIPS	MM	IN	MM	IN	MPA SQRT(M)	KSI SQRT(IN)	FULL SECTION MPA	KSI	NET SECTION MPA	KSI
0.0	0.0	36.24	1.190	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00
9.0	2.0	37.00	1.349	2.75	.108	65.44	60.67	200.11	29.02	257.04	37.27
109.0	24.5	36.73	1.357	4.51	.177	77.92	72.27	216.26	31.36	282.31	40.96
109.0	24.5	37.01	1.477	7.27	.286	79.23	72.07	221.65	32.14	296.23	42.96
113.0	25.6	40.09	1.579	9.34	.369	85.35	77.67	229.73	33.31	314.27	45.57

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FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 1.60 mm (.063 inch)

Orientation: Longitudinal

Temperature: 144°K (-200°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

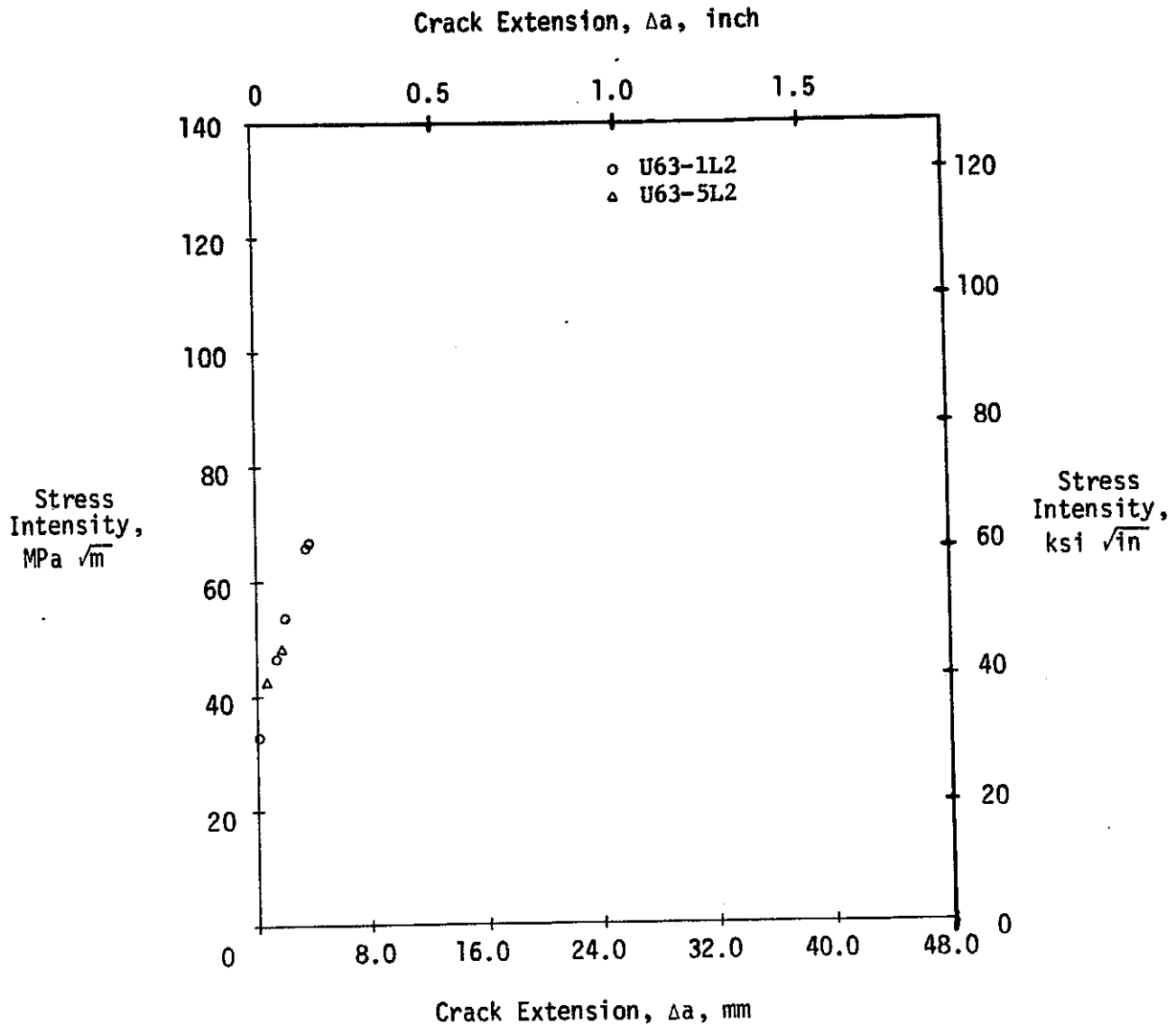
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FIGURE C2-1

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FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 1.60 mm (.063 inch)

Orientation: Longitudinal

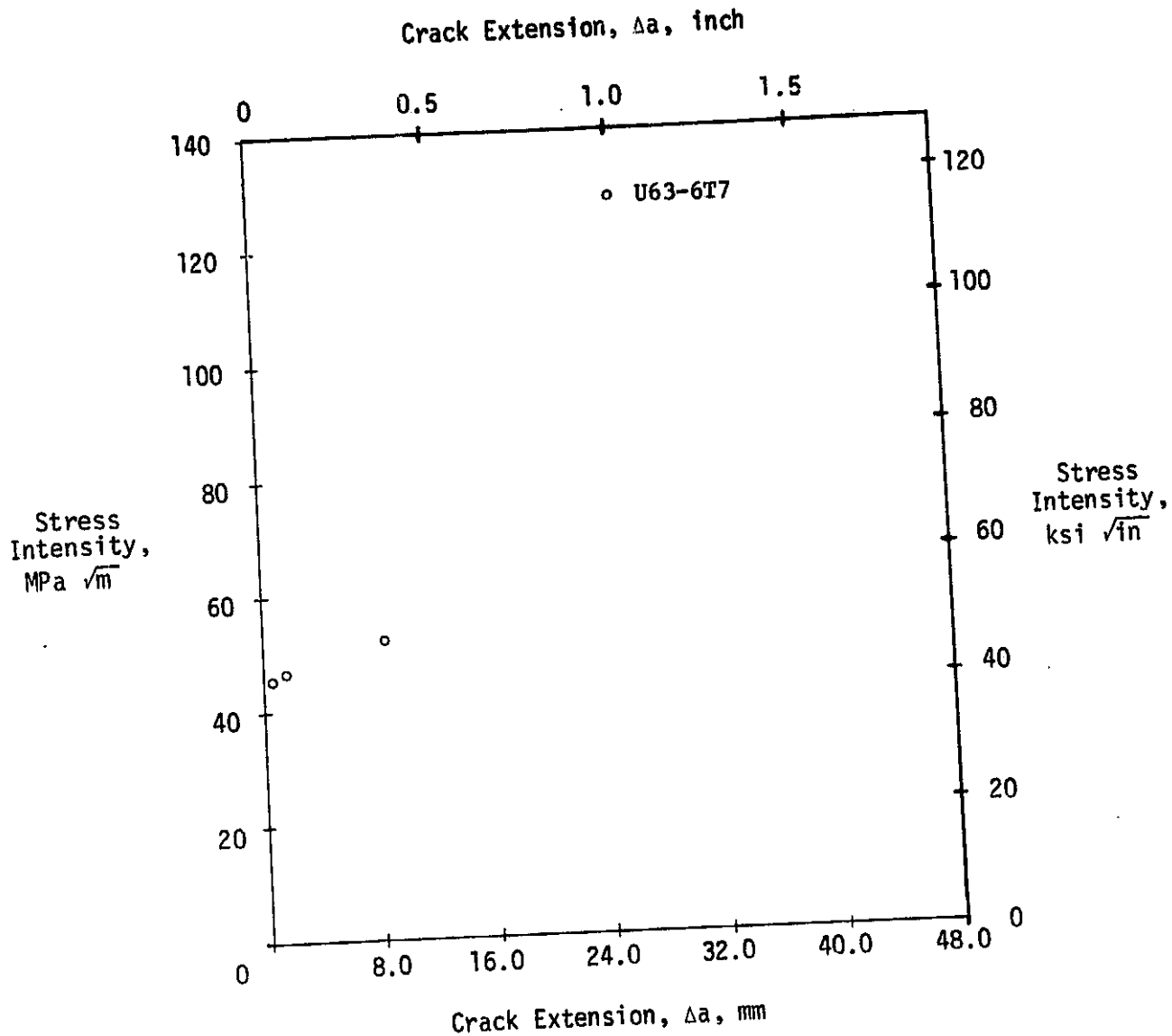
Temperature: 298°K (70°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

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FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 1.60 mm (.063 inch)

Orientation: Transverse

Temperature: 298°K (70°F)

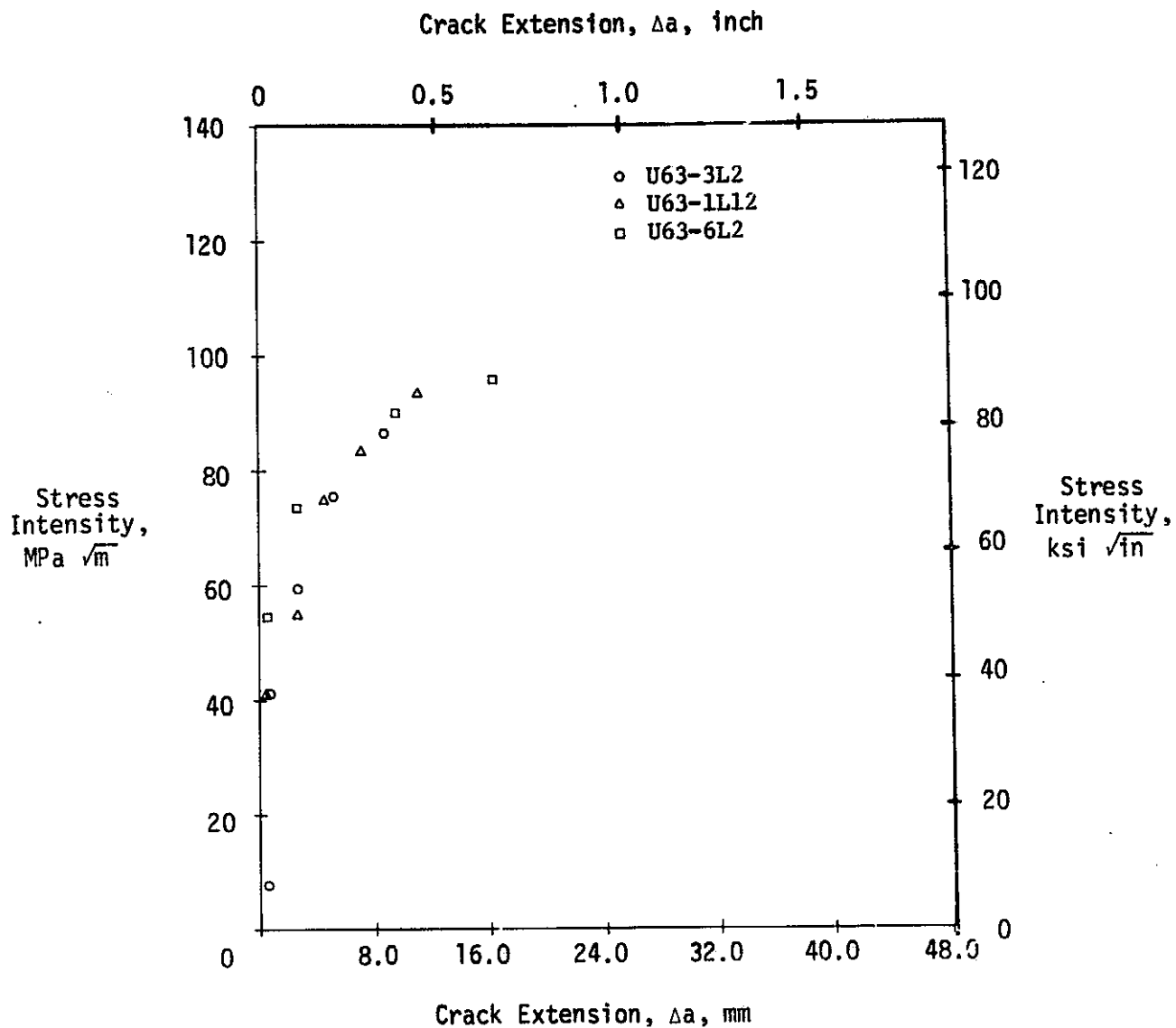
CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

FIGURE C2-3

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FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 1.60 mm (.063 inch)

Orientation: Longitudinal

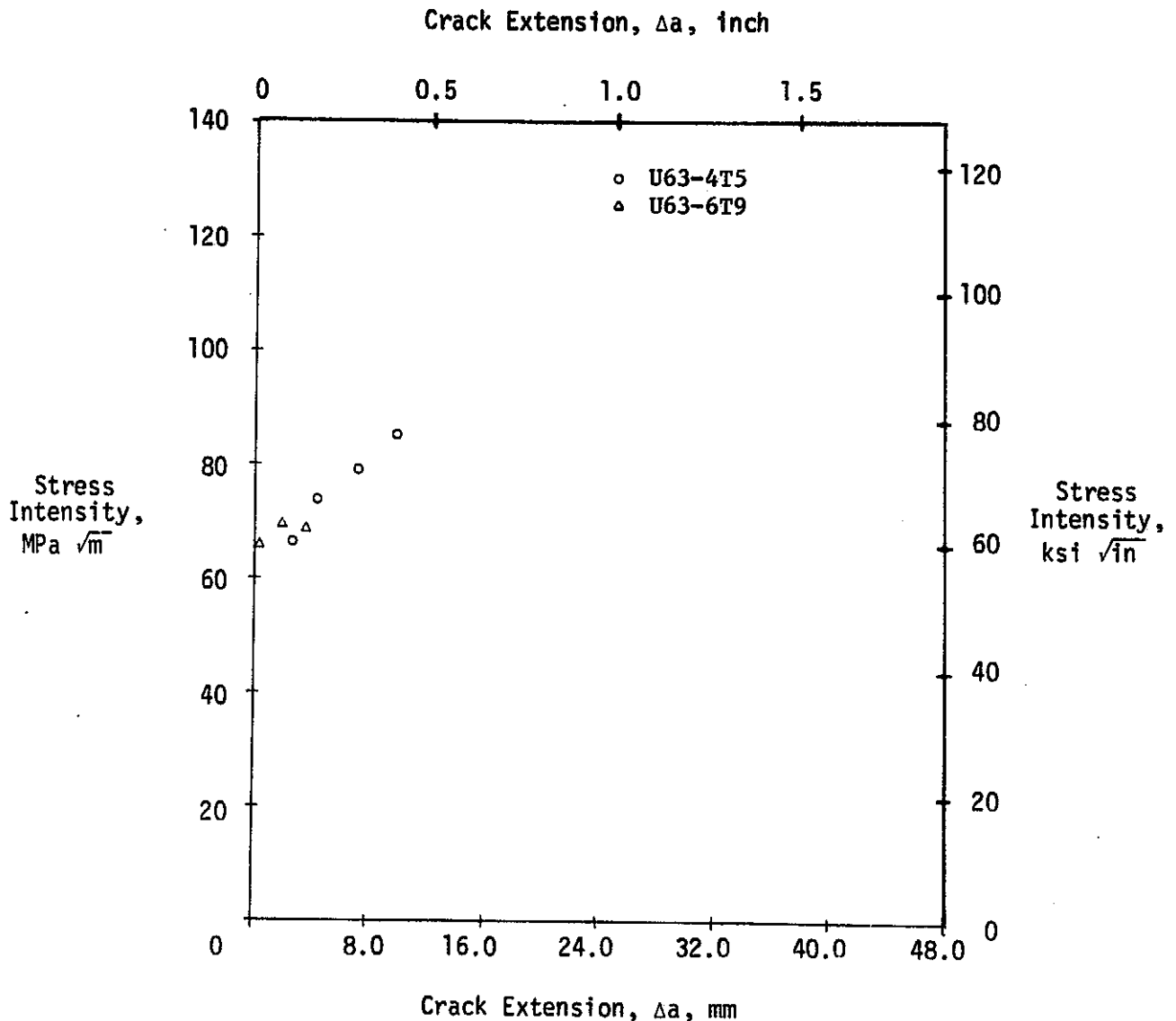
Temperature: 450°K (350°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 1.60 mm (.063 inch)

Orientation: Transverse

Temperature: 450°K (350°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974

SECTION C3. FRACTURE TOUGHNESS TEST DATA FOR 3.18 mm
(.125 INCH) THICK 2024-T861, BUCKLING RESTRAINED.

TABLE C3-1.
Fracture Toughness Test Data for 2024-T861 Specimens
(3.18 mm (.125 inch) Thick, Buckling Restrained)

Specimen Number	Temperature (K)	Orientation	Thickness mm	Specimen Width in	Pre-crack Length in	Pre-crack Load kip	Failure Load kip	Full Section Failure Stress MPa	Critical Stress Intensity, K_{IC} ksi \sqrt{in}	Data Table No.	Figure No.					
125-1L1	144	L	3.19	.1254	82.04	3.23	53.4	12.0	116.1	26.1	122.3	17.7	51.9	47.2	C3-2	C3-1
125-2L16	144	L	3.19	.1256	29.832	11.745	111.2	25.0	210.8	47.4	221.5	32.1	56.1	51.1	C3-3	C3-1
125-2L5	144	L	3.22	.1267	29.789	11.728	9.86	37.0	296.3	66.6	309.1	44.8	51.0	46.4	C3-4	C3-1
									AVG: 53.0	48.2						
125-3L2	294	L	3.21	.1265	29.809	11.736	125.25	4.93	75.6	17.0	122.3	27.5	68.3	62.3	C3-5	C3-3
125-5L4	294	L	3.20	.1261	29.804	11.734	81.74	3.22	62.3	14.0	135.7	30.5	58.1	53.9	C3-6	C3-3
125-3L4	294	L	3.20	.1260	29.812	11.737	40.54	1.60	89.0	20.0	192.8	43.3	55.5	50.5	C3-7	C3-3
125-5L3	294	L	3.24	.1277	29.807	11.735	12.01	.47	173.5	39.0	302.5	68.0	58.6	53.3	C3-8	C3-3
									AVG: 60.1	54.7						
125-2L11	450	L	3.23	.1273	29.799	11.732	65.28	2.57	124.6	28.0	210.0	47.2	31.6	NSY	C3-9	C3-5
125-6L1	450	L	3.21	.1265	29.794	11.730	98.73	3.89	97.9	22.0	213.1	47.9	32.3	NSY	C3-10	C3-5
125-7L2	450	L	3.26	.1285	29.794	11.730	82.47	3.25	75.6	17.0	226.4	50.9	33.8	NSY	C3-11	C3-5
125-4T5	144	T	3.23	.1270	29.863	11.757	88.72	3.49	35.6	8.0	83.3	18.7	12.5	38.3	C3-12	C3-2
125-6T1	144	T	3.26	.1282	29.779	11.724	25.88	1.02	57.8	13.0	149.9	33.2	36.0	32.8	C3-13	C3-2
125-4T4	144	T	3.24	.1277	29.837	11.747	12.80	.50	115.7	26.0	210.2	47.2	31.5	34.3	C3-14	C3-2
									AVG: 37.3	34.0						
125-1T2	294	T	3.20	.1259	29.820	11.740	82.52	3.25	44.5	10.0	108.5	24.4	16.5	42.3	C3-15	C3-4
125-1T6	294	T	3.26	.1284	29.815	11.738	39.65	1.56	89.0	20.0	145.0	32.6	43.8	39.9	C3-16	C3-4
125-3T5	294	T	3.20	.1258	29.812	11.737	13.26	.52	129.0	29.9	234.9	52.8	43.7	39.8	C3-17	C3-4
									AVG: 44.6	40.7						
125-5T8	450	T	3.25	.1280	29.820	11.740	50.47	1.99	75.6	17.0	256.2	57.6	38.3	NSY	C3-18	C3-6
125-3T9	450	T	3.21	.1265	29.804	11.734	70.08	2.76	102.3	23.0	207.7	46.7	31.5	NSY	C3-19	C3-6
125-3T4	450	T	3.26	.1282	29.848	11.751	96.34	3.79	84.5	19.0	171.7	38.6	25.6	NSY	C3-20	C3-6

NSY: Net section stress > 0.2 percent offset yield strength prior to failure

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TABLE C3-2

SPECIMEN NUMBER: 125-1L1
ALLOY: 2024-T861
ORIENTATION: LONGITUDINAL
CONSTRAINT: STIFFENED
TEST TEMPERATURE: 144.0 K
SPECIMEN THICKNESS: 3.19 MM (.125 IN)
K(MAX) DURING PRECRACKING: 21.19 MPA SQRT(M) (19.23 KSI SQRT(IN))

LOAD		COD		A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS	
KN	KIPS	E-3 MM	E-3 IN	MM	IN	MM	IN	MPA SQRT(M)	KSI SQRT(IN)	FULL SECTION MPA	NET SECTION KSI
0.0	0.0	0.00	0.00	41.02	1.615	0.00	0.000	0.00	0.00	0.00	0.00
72.3	16.3	191.95	7.56	41.71	1.642	0.69	0.027	25.03	26.89	78.22	17.55
74.1	16.6	201.74	7.95	42.44	1.671	1.42	0.056	26.83	27.81	78.53	17.58
89.7	20.2	248.41	9.78	43.04	1.695	2.02	0.080	30.68	33.38	94.57	21.37
107.4	24.1	306.12	12.05	43.90	1.728	2.88	0.113	44.42	43.43	118.17	26.81
112.1	25.2	326.19	12.84	44.60	1.756	3.58	0.141	46.81	42.63	118.08	26.80
114.9	25.7	343.76	13.53	45.88	1.799	4.66	0.184	48.55	44.18	128.67	28.82
115.9	26.0	350.37	14.18	47.06	1.853	6.04	0.238	49.89	45.41	121.70	27.65
115.7	26.0	375.12	14.77	48.51	1.910	7.49	0.295	51.98	46.39	121.96	27.69
115.7	26.0	387.67	15.26	49.76	1.959	8.74	0.344	51.82	47.16	121.96	27.69

TABLE C3-3

SPECIMEN NUMBER: 125-2L16
ALLOY: 2024-T861
ORIENTATION: LONGITUDINAL
CONSTRAINT: STIFFENED
TEST TEMPERATURE: 144.0 K
SPECIMEN THICKNESS: 3.19 MM (.125 IN)
K(MAX) DURING PRECRACKING: 23.35 MPA SQRT(M) (21.25 KSI SQRT(IN))

LOAD		COD		A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS	
KN	KIPS	E-3 MM	E-3 IN	MM	IN	MM	IN	MPA SQRT(M)	KSI SQRT(IN)	FULL SECTION MPA	NET SECTION KSI
0.0	0.0	0.00	0.00	12.53	.496	0.00	0.000	0.00	0.00	0.00	0.00
107.4	24.1	79.93	3.15	12.72	.501	0.24	0.005	22.57	23.63	112.30	25.13
145.2	32.6	114.57	4.35	12.94	.515	0.42	0.009	25.79	26.81	117.20	26.80
164.4	36.9	137.57	5.14	13.27	.523	0.68	0.027	35.44	32.20	119.45	26.80
185.4	41.7	155.79	6.17	13.34	.549	1.34	0.053	40.99	37.30	123.30	28.81
193.8	43.4	165.33	6.53	14.08	.554	1.83	0.075	42.00	39.00	123.30	28.81
207.3	46.5	177.38	6.99	14.33	.576	2.63	0.103	44.00	40.99	123.30	28.81
207.3	46.5	188.93	7.44	15.16	.593	3.50	0.138	46.00	42.70	123.30	28.81
210.4	47.3	202.49	7.97	15.35	.624	4.17	0.164	48.00	44.99	121.70	27.65
210.4	47.3	214.55	8.60	16.77	.660	4.17	0.164	48.00	44.99	121.70	27.65
211.3	47.5	237.60	9.16	17.77	.700	4.17	0.164	48.00	44.99	121.70	27.65
211.3	47.5	249.16	9.81	18.94	.745	4.17	0.164	48.00	44.99	121.70	27.65

TABLE C3-4

SPECIMEN NUMBER: 125-215
 ALLOY: 2124-T861
 ORIENTATION: LONGITUDINAL
 CONSTRAINT: STIFFENED
 TEST TEMPERATURE: 149.0 K
 SPECIMEN THICKNESS: 3.22 MM (0.127 IN)
 K (MAX) DURING PRECRACKING: 21.57 MPA SQRT (M) (19.63 KSI SQRT (IN))

KN	LOAD KIPS	COD		A, HALF CRACK LENGTH		DELTA A		STRESS MPA	INTENSITY KSI	FULL SECTION MPA	STRESS KSI	NET SECTION MPA	KSI
		E-3 MM	E-3 IN	MM	IN	MM	IN						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21.6	4.8	65.3	2.6	5.3	.197	0.03	0.003	23.53	3.36	23.53	3.36	23.53	3.36
22.0	5.0	65.3	2.6	5.3	.200	0.07	0.003	23.53	3.36	23.53	3.36	23.53	3.36
22.4	5.1	65.3	2.6	5.3	.203	0.09	0.003	23.53	3.36	23.53	3.36	23.53	3.36
22.8	5.2	65.3	2.6	5.3	.206	1.43	0.056	41.69	37.94	202.68	42.46	44.77	64.72
23.2	5.3	65.3	2.6	5.3	.209	2.36	0.093	45.67	41.56	209.57	43.46	44.77	64.72
23.6	5.4	65.3	2.6	5.3	.212	3.38	0.133	49.80	45.32	205.98	44.46	44.77	64.72
24.0	5.5	65.3	2.6	5.3	.215	3.95	0.156	52.59	47.40	203.71	44.46	44.77	64.72
24.4	5.6	65.3	2.6	5.3	.218	4.18	0.165	52.60	47.87	203.74	44.46	44.77	64.72
24.8	5.7	65.3	2.6	5.3	.221	4.18	0.165	52.63	47.87	203.74	44.46	44.77	64.72

TABLE C3-5

SPECIMEN NUMBER: 125-312
 ALLOY: 2124-T861
 ORIENTATION: LONGITUDINAL
 CONSTRAINT: STIFFENED
 TEST TEMPERATURE: 294.0 K
 SPECIMEN THICKNESS: 3.21 MM (0.127 IN)
 K (MAX) DURING PRECRACKING: 39.40 MPA SQRT (M) (35.86 KSI SQRT (IN))

KN	LOAD KIPS	COD		A, HALF CRACK LENGTH		DELTA A		STRESS MPA	INTENSITY KSI	FULL SECTION MPA	STRESS KSI	NET SECTION MPA	KSI
		E-3 MM	E-3 IN	MM	IN	MM	IN						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.0	2.5	65.3	2.6	5.3	.197	0.03	0.003	57.63	52.45	115.00	16.01	16.01	23.53
11.4	2.6	65.3	2.6	5.3	.200	1.40	0.059	61.20	55.77	123.70	17.01	17.01	23.53
11.8	2.7	65.3	2.6	5.3	.203	2.48	0.098	63.78	58.05	124.67	17.01	17.01	23.53
12.2	2.8	65.3	2.6	5.3	.206	3.75	0.149	66.80	61.14	126.61	18.01	18.01	23.53
12.6	2.9	65.3	2.6	5.3	.209	4.96	0.194	67.83	61.73	128.11	18.01	18.01	23.53
13.0	3.0	65.3	2.6	5.3	.212	5.86	0.231	68.44	62.28	127.85	18.01	18.01	23.53

TABLE C3-6

SPECIMEN NUMBER: 125-5L4
ALLOY: 2024-T861
ORIENTATION: LONGITUDINAL
CONSTRAINT: STIFFENED
TEST TEMPERATURE: 294.0 K
SPECIMEN THICKNESS: 3.20 MM (.126 IN)
K (MAX) DURING PRECRACKING: 24.52 MPA SQRT (M) (22.32 KSI SQRT (IN))

LOAD		COD		A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS	
KN	KIPS	E-3 MM	E-3 IN	MM	IN	MM	IN	MPA SQRT (M)	KSI SQRT (IN)	FULL SECTION MPA	NET SECTION KSI
0	0.0	227.1	9.10	40.87	1.609	0.00	0.000	0.00	0.00	0.00	0.00
0	0.0	271.1	10.68	40.90	1.610	0.00	0.001	32.59	29.75	86.79	12.00
0	0.0	306.7	12.07	43.96	1.731	0.00	0.004	38.72	35.24	102.90	14.00
0	0.0	344.6	13.57	41.27	1.627	0.00	0.016	43.48	39.49	114.80	16.00
0	0.0	370.2	14.56	42.17	1.660	0.00	0.051	47.93	43.22	125.15	18.00
0	0.0	417.4	16.43	42.88	1.688	0.00	0.079	50.86	46.28	131.45	19.00
0	0.0	454.3	17.87	43.66	1.716	0.00	0.131	53.13	48.66	137.97	20.00
0	0.0	460.1	18.11	44.29	1.746	0.00	0.153	54.39	49.99	139.97	20.00
0	0.0	460.1	18.11	45.42	1.788	0.00	0.183	56.60	51.33	141.70	20.00
0	0.0	460.1	18.11	46.49	1.831	0.00	0.220	57.22	52.07	141.66	20.00
0	0.0	453.7	17.87	47.64	1.876	0.00	0.267	58.09	52.86	143.60	20.00

TABLE C3-7

SPECIMEN NUMBER: 125-3L4
ALLOY: 2024-T861
ORIENTATION: LONGITUDINAL
CONSTRAINT: STIFFENED
TEST TEMPERATURE: 294.0 K
SPECIMEN THICKNESS: 3.20 MM (.126 IN)
K (MAX) DURING PRECRACKING: 23.80 MPA SQRT (M) (21.65 KSI SQRT (IN))

LOAD		COD		A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS	
KN	KIPS	E-3 MM	E-3 IN	MM	IN	MM	IN	MPA SQRT (M)	KSI SQRT (IN)	FULL SECTION MPA	NET SECTION KSI
0	0.0	14.73	0.58	20.27	.794	0.00	0.000	0.00	0.00	0.00	0.00
0	0.0	15.88	0.62	20.39	.803	0.00	0.005	23.31	21.58	114.48	16.00
0	0.0	17.73	0.69	20.67	.814	0.00	0.016	29.66	27.72	126.67	18.00
0	0.0	19.33	0.76	20.86	.821	0.00	0.022	31.66	29.15	140.64	19.00
0	0.0	20.33	0.80	21.17	.833	0.00	0.035	36.83	33.15	156.37	22.00
0	0.0	21.33	0.84	21.71	.855	0.00	0.071	40.14	37.15	174.36	25.00
0	0.0	22.33	0.88	22.38	.889	1.65	0.086	46.73	44.32	182.45	26.00
0	0.0	23.33	0.92	22.96	.902	1.81	0.071	48.55	46.09	187.99	27.00
0	0.0	24.33	0.96	23.55	.927	2.19	0.086	50.67	48.18	194.55	28.00
0	0.0	25.33	1.00	23.74	.935	2.63	0.104	52.78	49.78	198.03	28.00
0	0.0	26.33	1.03			3.28	0.129	54.78	50.56	201.04	29.00
0	0.0	27.33	1.07			3.47	0.137	55.49			

SPECIMEN NUMBER:	125-5L1
ALLOY:	2024-T861
ORIENTATION:	LONGITUDINAL
CONSTRAINT:	STIFFENED
TEST TEMPERATURE:	294.0 K
SPECIMEN THICKNESS:	3.24 MM (0.128 IN)
K (MAX) DURING PRECRACKING:	24.67 MPA SQRT(M) (22.46 KSI SQRT(IN))

[illegible]

TABLE C3-9

SPECIMEN NUMBER: 125-2L11
 ALLOY: 2024-T861
 ORIENTATION: LONGITUDINAL
 CONSTRAINT: STIFFENED
 TEST TEMPERATURE: 450.3 K
 SPECIMEN THICKNESS: 3.23 MM (.127 IN)
 K (MAX) DURING PRECRACKING: 42.66 MPa SQRT (M) (39.82 KSI SQRT (IN))

LOAD		COJ		A HALF		DELTA A		STRESS		INTENSITY		FULL SECTION		STRESS	
KN	KIPS	F-3 M4	E-3 IN	CPACK	LENGTH	MM	IN	MPA	SQRT(4)	KSI	SQRT(IN)	MPA	SECTION	KSI	NET SECTION
				MM	IN										
1	1.1	1.1	1.1	32	1.245	0.40	0.015	4.0	2.0	3.0	1.0	16	0.0	0.0	0.0
2	2.2	2.2	2.2	33	1.310	0.45	0.018	4.5	2.2	3.3	1.1	17	0.0	0.0	0.0
3	3.3	3.3	3.3	34	1.375	0.50	0.020	5.0	2.4	3.6	1.2	18	0.0	0.0	0.0
4	4.4	4.4	4.4	35	1.440	0.55	0.022	5.5	2.6	3.9	1.3	19	0.0	0.0	0.0
5	5.5	5.5	5.5	36	1.505	0.60	0.024	6.0	2.8	4.2	1.4	20	0.0	0.0	0.0
6	6.6	6.6	6.6	37	1.570	0.65	0.026	6.5	3.0	4.5	1.5	21	0.0	0.0	0.0
7	7.7	7.7	7.7	38	1.635	0.70	0.028	7.0	3.2	4.8	1.6	22	0.0	0.0	0.0
8	8.8	8.8	8.8	39	1.700	0.75	0.030	7.5	3.4	5.1	1.7	23	0.0	0.0	0.0
9	9.9	9.9	9.9	40	1.765	0.80	0.032	8.0	3.6	5.4	1.8	24	0.0	0.0	0.0
10	11.0	11.0	11.0	41	1.830	0.85	0.034	8.5	3.8	5.7	1.9	25	0.0	0.0	0.0
11	12.1	12.1	12.1	42	1.895	0.90	0.036	9.0	4.0	6.0	2.0	26	0.0	0.0	0.0
12	13.2	13.2	13.2	43	1.960	0.95	0.038	9.5	4.2	6.3	2.1	27	0.0	0.0	0.0
13	14.3	14.3	14.3	44	2.025	1.00	0.040	10.0	4.4	6.6	2.2	28	0.0	0.0	0.0
14	15.4	15.4	15.4	45	2.090	1.05	0.042	10.5	4.6	6.9	2.3	29	0.0	0.0	0.0
15	16.5	16.5	16.5	46	2.155	1.10	0.044	11.0	4.8	7.2	2.4	30	0.0	0.0	0.0
16	17.6	17.6	17.6	47	2.220	1.15	0.046	11.5	5.0	7.5	2.5	31	0.0	0.0	0.0
17	18.7	18.7	18.7	48	2.285	1.20	0.048	12.0	5.2	7.8	2.6	32	0.0	0.0	0.0
18	19.8	19.8	19.8	49	2.350	1.25	0.050	12.5	5.4	8.1	2.7	33	0.0	0.0	0.0
19	20.9	20.9	20.9	50	2.415	1.30	0.052	13.0	5.6	8.4	2.8	34	0.0	0.0	0.0
20	22.0	22.0	22.0	51	2.480	1.35	0.054	13.5	5.8	8.7	2.9	35	0.0	0.0	0.0
21	23.1	23.1	23.1	52	2.545	1.40	0.056	14.0	6.0	9.0	3.0	36	0.0	0.0	0.0
22	24.2	24.2	24.2	53	2.610	1.45	0.058	14.5	6.2	9.3	3.1	37	0.0	0.0	0.0
23	25.3	25.3	25.3	54	2.675	1.50	0.060	15.0	6.4	9.6	3.2	38	0.0	0.0	0.0
24	26.4	26.4	26.4	55	2.740	1.55	0.062	15.5	6.6	9.9	3.3	39	0.0	0.0	0.0
25	27.5	27.5	27.5												

TABLE C3-10

SPECIMEN NUMBER: 125-6L7
 ALL DY: 2024-T861
 ORIENTATION: LONGITUDINAL
 CONSTRAINT: STIFFENED
 TEST TEMPERATURE: 450.0 K
 SPECIMEN THICKNESS: 3.21 MM (.127 IN)
 K (MAX) DURING PRECRACKING: 43.22 MPA SQRT(M) (39.33 KSI SQRT(IN))

[illegible]

TABLE C3-17

SPECIMEN NUMBER: 125-7L2
 ALLOY: 2024-T861
 ORIENTATION: LONGITUDINAL
 CONSTRAINT: STIFFENED
 TEST TEMPERATURE: 453.0 K
 SPECIMEN THICKNESS: 3.26 MM (.128 IN)
 K (MAX) DURING PRECRACKING: 29.39 MPA SQRT(M) (26.75 KSI SQRT(IN))

LOAD		COD		A HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS	
KN	KIPS	E-3 MM	E-3 IN	MM	IN	MM	IN	MPA SQRT(M)	KSI SQRT(IN)	FULL SECTION MPA	NET SECTION KSI
0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.000	0.00	0.00	0.00	0.00
28.0	6.4	7.4	0.29	41.7	1.64	0.26	0.010	11.58	18.29	0.00	0.00
70.5	15.9	20.5	0.81	42.1	1.658	0.89	0.035	27.77	25.27	2.22	40.51
226.4	50.9	38.5	1.51	42.9	1.691	1.72	0.068	50.35	45.82	18.85	26.49
180.3	40.5	49.9	1.98	44.2	1.741	0.97	0.117	62.57	56.94	22.32	32.73
197.7	44.4	53.7	2.11	46.3	1.824	1.10	0.201	75.27	68.59	26.89	39.09
207.7	46.7	75.4	2.97	48.3	1.904	1.11	0.280	84.67	77.07	29.05	43.59
216.5	48.7	86.6	3.41	51.1	2.012	0.87	0.389	92.58	84.07	33.63	49.16
222.9	50.1	99.5	3.98	54.3	2.139	0.99	0.516	100.35	91.32	32.99	50.83
225.4	50.7	111.1	4.37	57.1	2.251	0.93	0.627	*	*	32.26	53.95
225.9	50.7	122.1	4.81	60.3	2.377	1.13	0.754	*	*	33.61	56.52
226.8	51.0	131.2	5.16	62.9	2.479	1.73	0.856	*	*	33.83	58.60
226.8	51.0	139.4	5.49	65.6	2.578	2.26	0.955	*	*	33.83	60.36

TABLE C3-12

SPECIMEN NUMBER: 125-4T5
ALLOY: 2024-T861
ORIENTATION: TRANSVERSE
CONSTRAINT: STIFFENED
TEST TEMPERATURE: 144.0 K
SPECIMEN THICKNESS: 3.23 MM (.127 IN)
K (MAX) DURING PRECRACKING: 14.99 MPA SQRT(M) (13.28 KSI SQRT(IN))

LOAD KN KIPS	E-3 MM	COD E-3 IN	A, HALF CRACK LENGTH MM IN	DELTA A MM IN	STRESS MPA SQRT(M)	INTENSITY KSI SQRT(IN)	FULL SECTION MPA KSI	STRESS NET SECTION MPA KSI
0.0	0.0	0.0	44.36	0.00	0.00	0.00	0.00	0.00
7.0	16.1	2.02	44.39	0.03	29.62	26.78	74.66	105.96
76.5	17.2	2.18	44.79	0.42	31.56	28.70	79.37	113.38
76.5	17.7	2.39	45.49	1.13	32.87	29.92	81.94	117.84
81.2	18.3	2.41	46.24	1.87	34.16	31.09	84.30	122.11
81.2	18.7	2.60	48.12	3.75	35.90	32.57	86.35	127.42
84.5	18.8	2.84	51.38	7.62	37.66	34.22	86.67	132.14
84.5	18.8	3.11	53.59	9.23	38.73	35.24	86.78	135.37

TABLE C3-13

SPECIMEN NUMBER: 125-6T1
ALLOY: 2024-T861
ORIENTATION: TRANSVERSE
CONSTRAINT: STIFFENED
TEST TEMPERATURE: 144.0 K
SPECIMEN THICKNESS: 3.26 MM (.128 IN)
K (MAX) DURING PRECRACKING: 12.08 MPA SQRT(M) (10.99 KSI SQRT(IN))

LOAD KN KIPS	E-3 MM	COD E-3 IN	A, HALF CRACK LENGTH MM IN	DELTA A MM IN	STRESS MPA SQRT(M)	INTENSITY KSI SQRT(IN)	FULL SECTION MPA KSI	STRESS NET SECTION MPA KSI
0.0	0.0	0.0	12.36	0.00	0.00	0.00	0.00	0.00
0.0	0.0	0.0	12.37	0.33	6.72	17.99	9.96	15.00
0.0	0.0	0.0	12.38	0.39	6.68	17.99	9.96	15.00
0.0	0.0	0.0	12.39	0.60	6.76	27.08	10.00	15.00
0.0	0.0	0.0	12.40	1.35	6.44	28.81	10.00	15.00
0.0	0.0	0.0	12.41	1.89	6.26	32.91	10.00	15.00
0.0	0.0	0.0	12.42	2.64	6.76	33.82	10.00	15.00
0.0	0.0	0.0	12.43	2.89	6.29	33.23	10.00	15.00
0.0	0.0	0.0	12.44	2.93	6.51	33.33	10.00	15.00
0.0	0.0	0.0	12.45	2.56	6.98	33.66	10.00	15.00

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TABLE C3-14

SPECIMEN NUMBER: 125-4T4
ALLOY: 2024-T861
ORIENTATION: TRANSVERSE
CONSTRAINT: STIFFENED
TEST TEMPERATURE: 144.0 K
SPECIMEN THICKNESS: 3.24 MM (.128 IN)
K(MAX) DURING PRECRACKING: 16.97 MPA SQRT(M) (15.44 KSI SQRT(IN))

KN	LOAD KIPS	E-3 MM COD	E-3 IN E-3 IN	A, HALF CRACK LENGTH MM	IN	DELTA A MM	IN	STRESS MPA	SQRT(M)	INTENSITY KSI	SQRT(IN)	STRESS	
												FULL SECTION MPA	NET SECTION KSI
0	0	0	0	6.40	.252	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00
0	0	0	0	6.64	.262	0.24	.010	11.88	10.81	13.42	11.11	11.88	13.42
0	0	0	0	6.79	.267	0.38	.015	14.74	13.42	17.99	14.08	14.74	17.99
0	0	0	0	6.73	.265	0.33	.013	23.17	21.09	27.93	23.34	23.17	27.93
0	0	0	0	6.79	.268	0.39	.016	25.69	23.34	29.69	25.69	25.69	29.69
0	0	0	0	6.92	.272	0.52	.021	27.93	25.69	31.86	27.93	27.93	31.86
0	0	0	0	7.13	.281	0.73	.029	29.69	27.93	32.44	29.69	29.69	32.44
0	0	0	0	7.51	.296	1.11	.044	31.86	31.86	34.91	31.86	31.86	34.91
0	0	0	0	7.35	.277	1.15	.046	32.44	32.44	35.64	32.44	32.44	35.64
0	0	0	0	8.38	.330	1.98	.078	34.91	34.91	37.21	34.91	34.91	37.21
0	0	0	0	8.64	.340	2.24	.088	35.64	35.64	37.72	35.64	35.64	37.72
0	0	0	0	9.32	.367	2.92	.115	37.21	37.21	38.86	37.21	37.21	38.86
0	0	0	0	9.58	.377	3.18	.125	37.72	37.72	39.33	37.72	37.72	39.33

TABLE C3-15

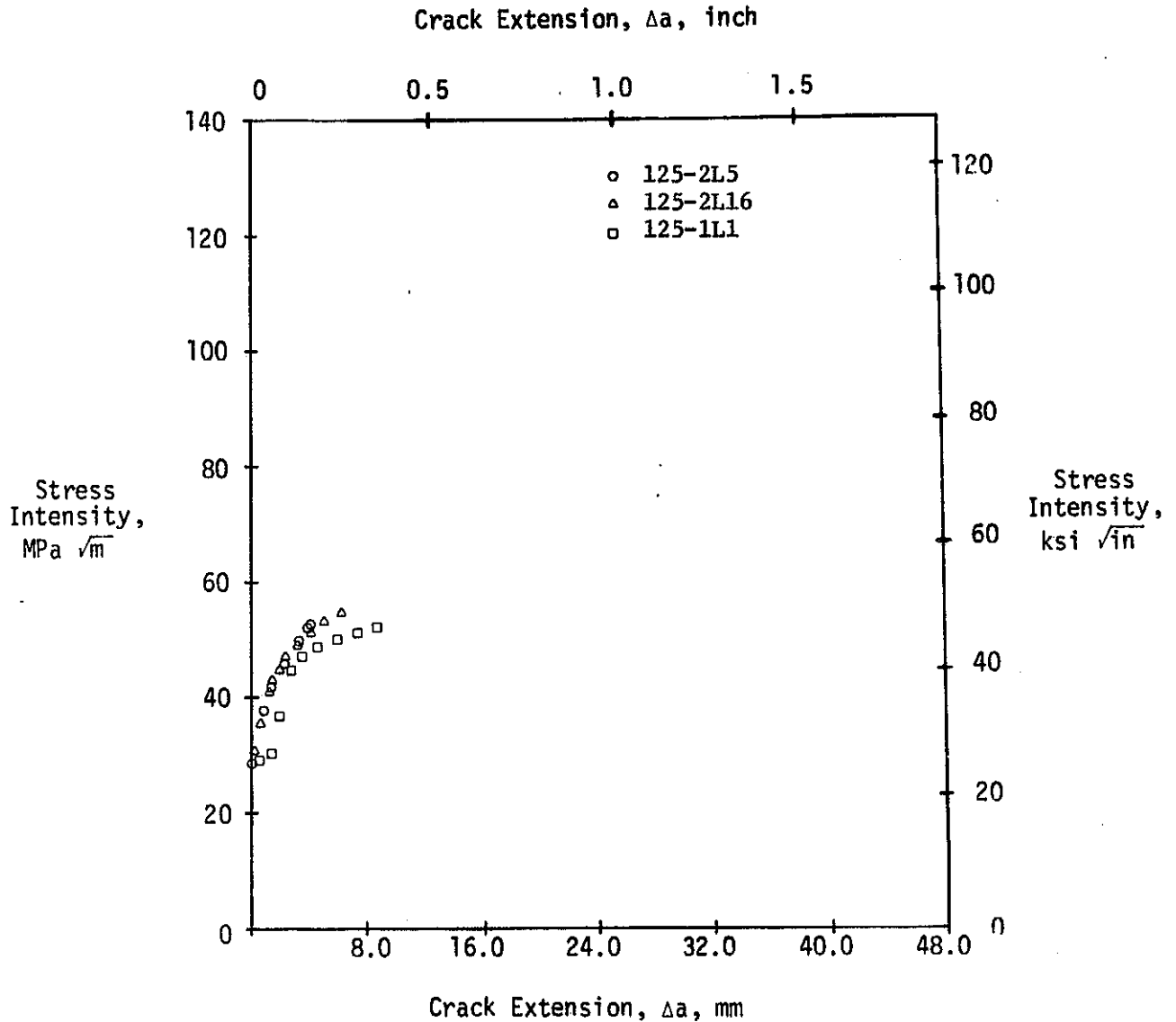
SPECIMEN NUMBER: 125-1T2
ALLOY: 2024-T861
ORIENTATION: TRANSVERSE
CONSTRAINT: STIFFENED
TEST TEMPERATURE: 294.0 K
SPECIMEN THICKNESS: 3.26 MM (.128 IN)
K(MAX) DURING PRECRACKING: 17.63 MPA SQRT(M) (16.65 KSI SQRT(IN))

KN	LOAD KIPS	E-3 MM COD	E-3 IN E-3 IN	A, HALF CRACK LENGTH MM	IN	DELTA A MM	IN	STRESS MPA	SQRT(M)	INTENSITY KSI	SQRT(IN)	STRESS	
												FULL SECTION MPA	NET SECTION KSI
0	0	0	0	41.26	1.624	0.50	0.000	0.00	0.00	0.00	0.00	0.00	0.00
0	0	0	0	41.41	1.633	0.15	.006	37.74	37.74	39.71	37.74	37.74	39.71
0	0	0	0	41.34	1.647	0.53	.021	39.67	39.67	41.61	39.67	39.67	41.61
0	0	0	0	42.38	1.657	0.62	.032	40.71	40.71	42.23	40.71	40.71	42.23
0	0	0	0	42.42	1.670	1.15	.045	41.61	41.61	42.76	41.61	41.61	42.76
0	0	0	0	42.69	1.673	1.33	.053	42.23	42.23	43.00	42.23	42.23	43.00
0	0	0	0	42.73	1.682	1.46	.058	42.76	42.76	43.41	42.76	42.76	43.41
0	0	0	0	42.73	1.682	1.47	.058	43.00	43.00	43.78	43.00	43.00	43.78
0	0	0	0	43.36	1.707	2.10	.083	43.41	43.41	44.13	43.41	43.41	44.13
0	0	0	0	43.75	1.723	2.49	.098	44.13	44.13	44.76	44.13	44.13	44.76
0	0	0	0	46.54	1.832	5.27	.208	46.65	46.65	47.41	46.65	46.65	47.41

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 3.18 mm (.125 inch)

Orientation: Longitudinal

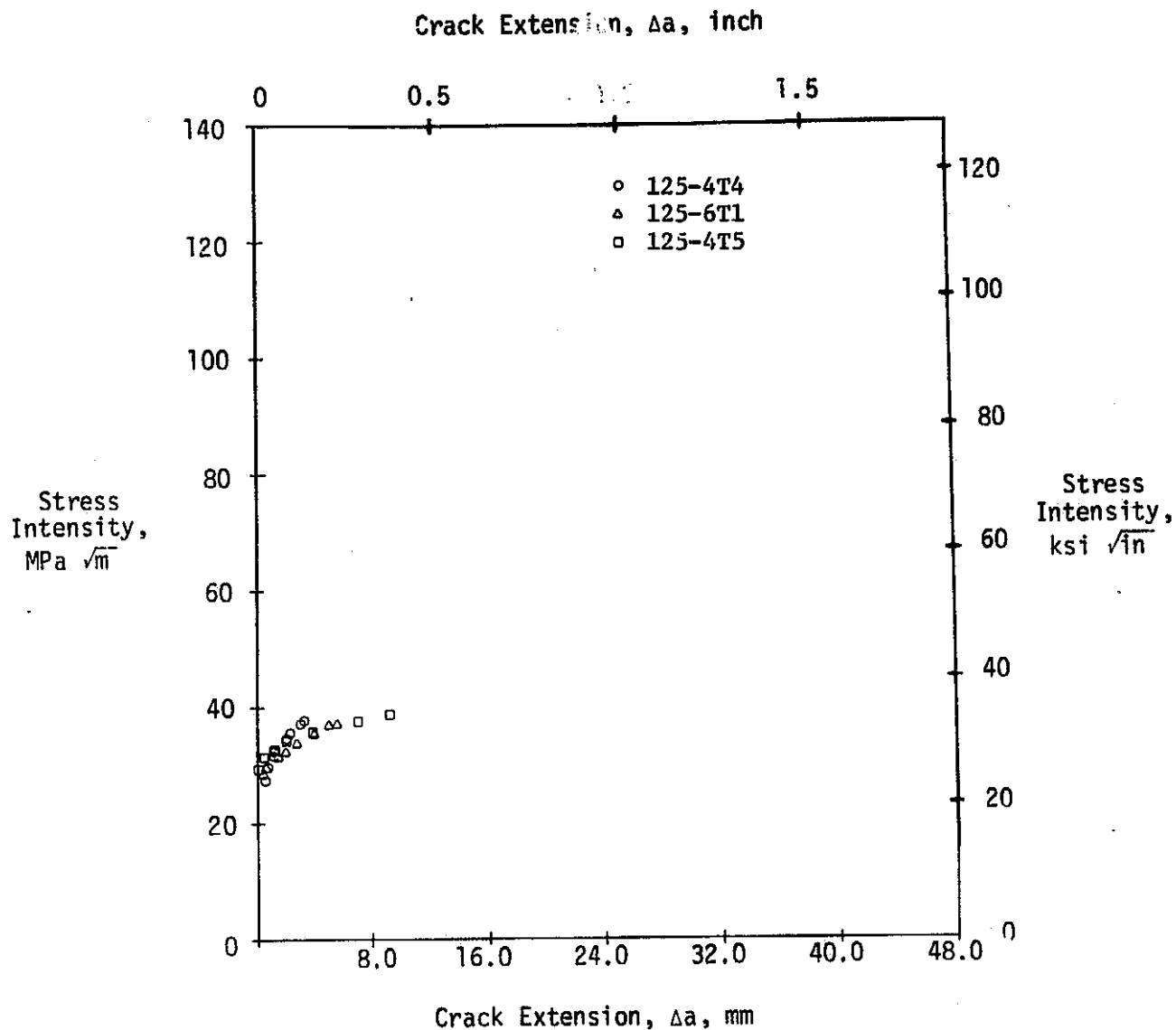
Temperature: 144°K (-200°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 3.18 mm (.125 inch)

Orientation: Transverse

Temperature: 144°K (-200°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

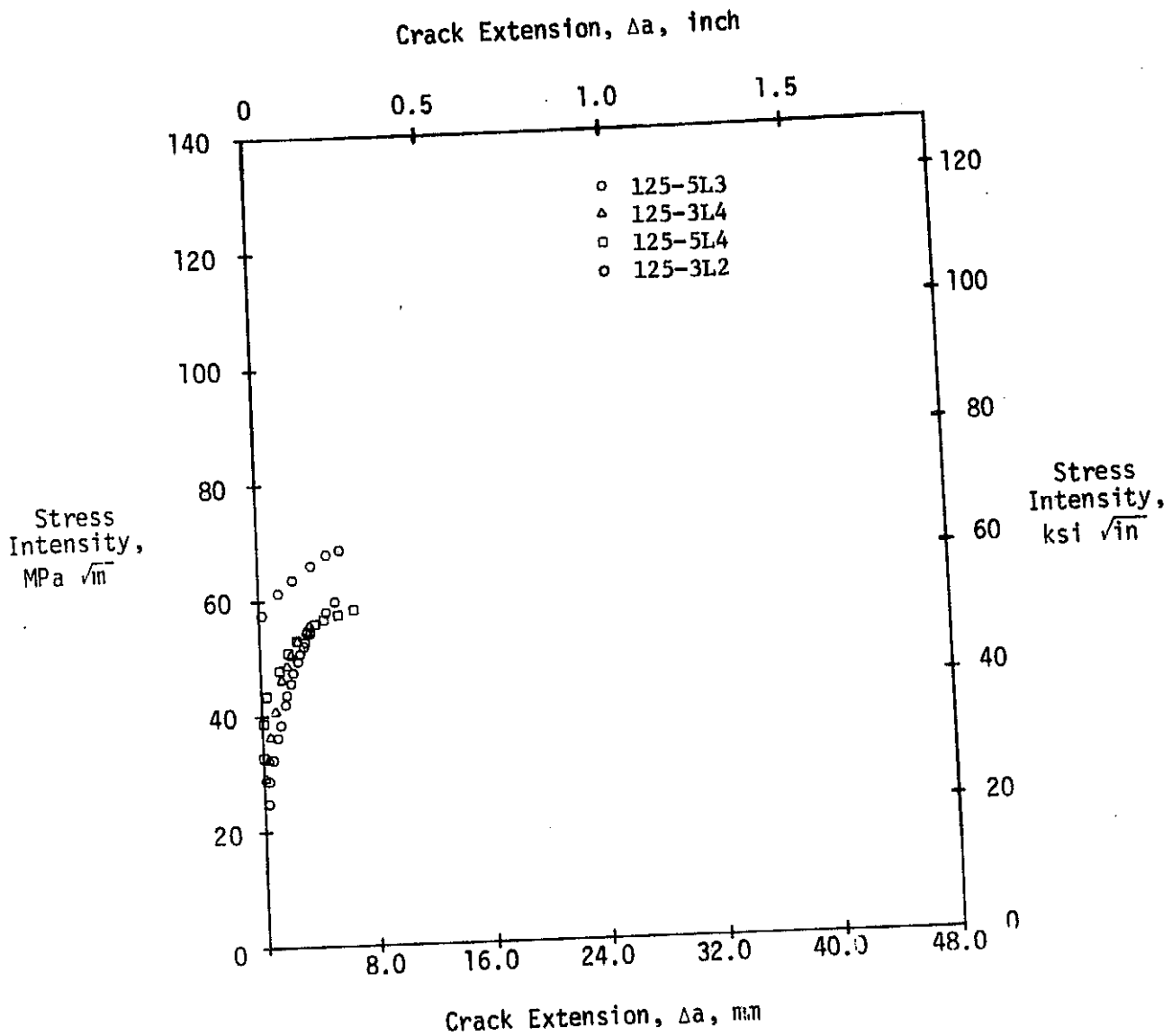
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FIGURE C3-2

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 3.18 mm (.125 inch)

Orientation: Longitudinal

Temperature: 298°K (70°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

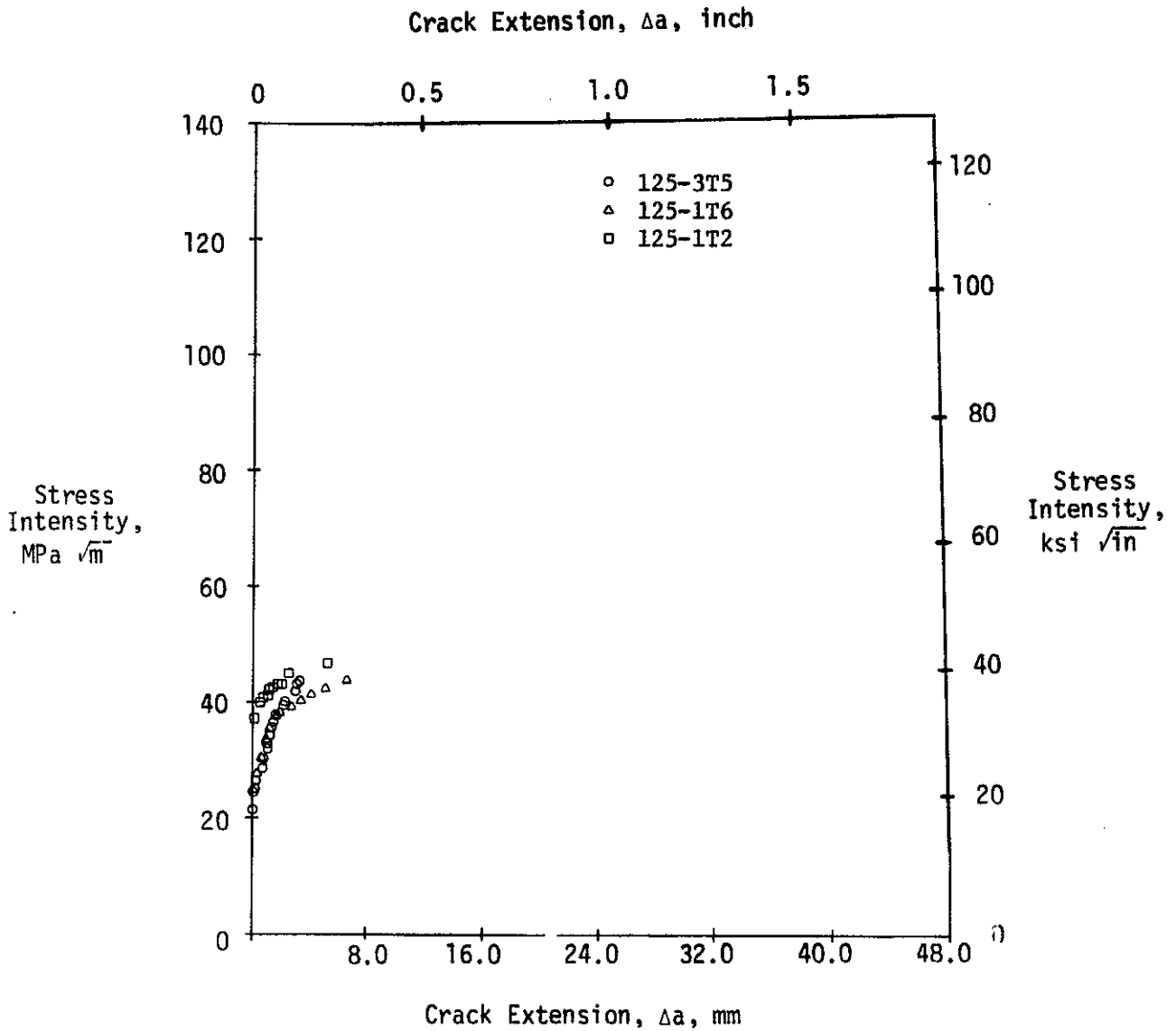
C-47

FIGURE C3-3

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 3.18 mm (.125 inch)

Orientation: Transverse

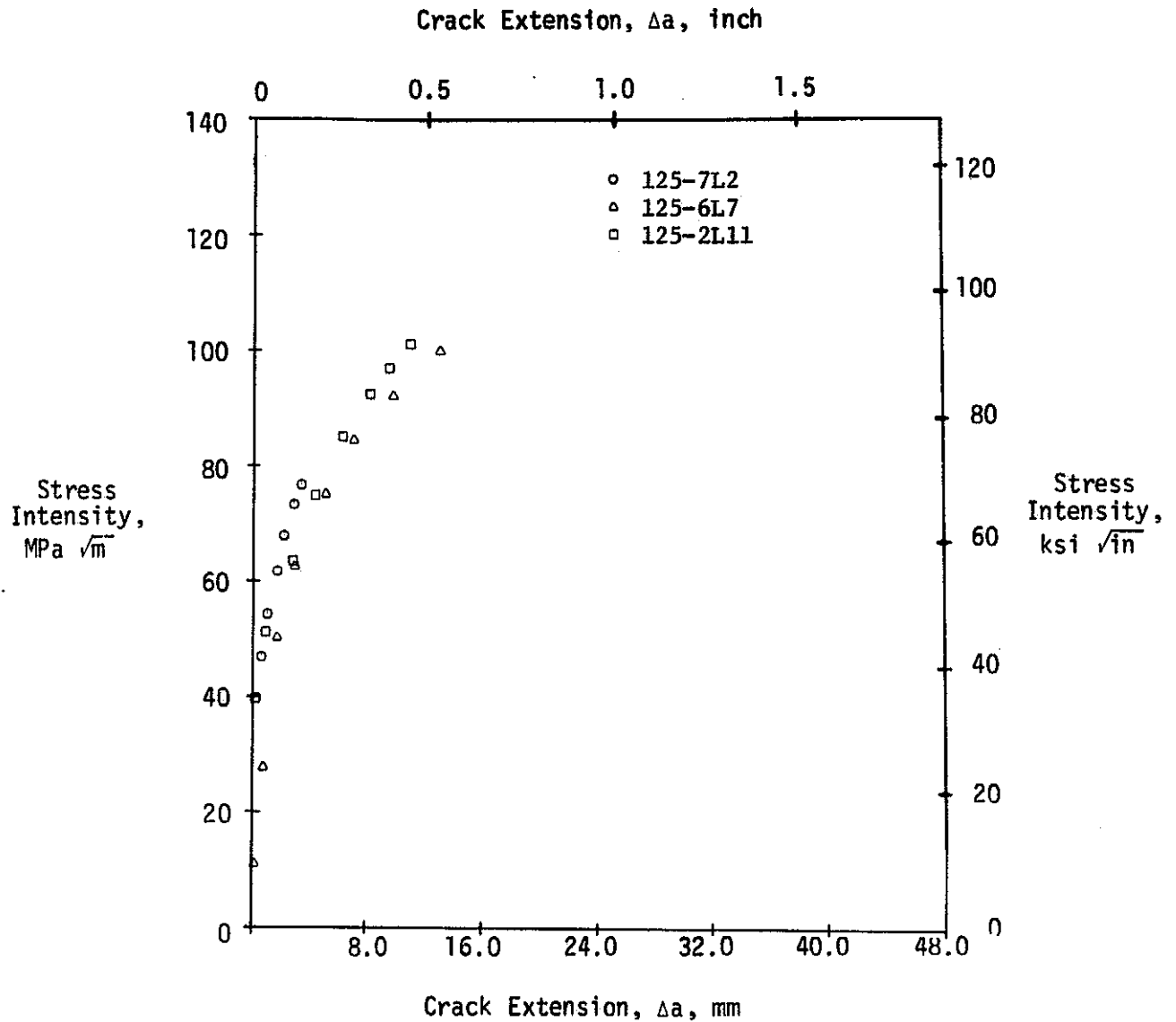
Temperature: 298°K (70°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 3.18 mm (.125 inch)

Orientation: Longitudinal

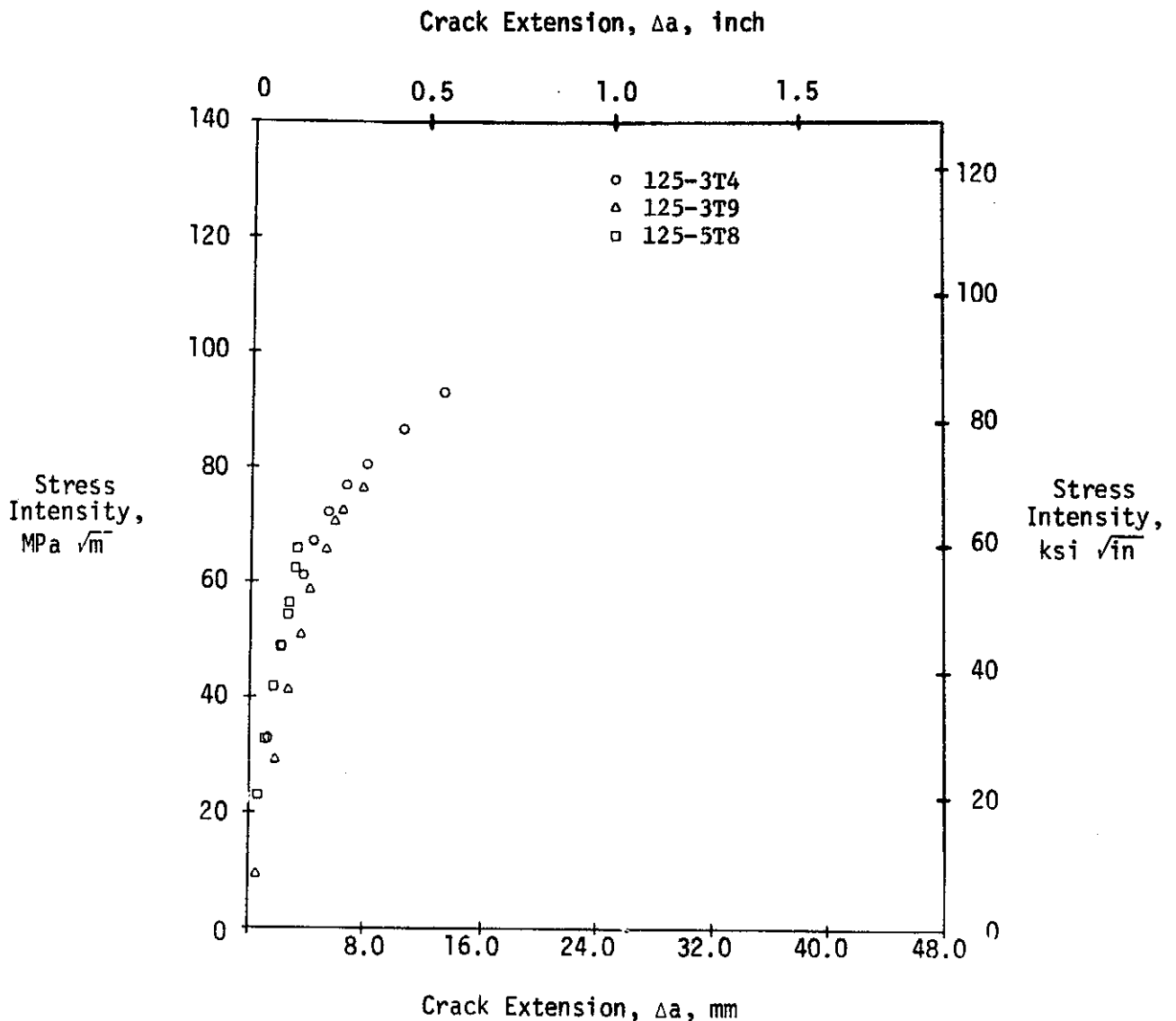
Temperature: 450°K (350°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 3.18 mm (.125 inch)

Orientation: Transverse

Temperature: 450°K (350°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

FINAL REPORT

**FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851**

**MDC E1153
October 1974**

**SECTION C4. FRACTURE TOUGHNESS TEST DATA FOR 3.18 mm
(.125 INCH) THICK 2024-T861, BUCKLING UNRESTRAINED**

TABLE C4-1.
Fracture Toughness Test Data for 2024-T861 Specimens
(3.18 mm (.125 inch) Thick, Buckling unrestrained)

Specimen Number	Temperature (K)	Orientation	Specimen Dimensions				Precrack Length		Precrack Load		Failure Load		Full Section Failure Stress		Critical Stress Intensity, K_{IC}		Data Table No.	Figure No.
			Thickness	in	cm	in	mm	in	kN	kip	kN	kip	MPa	ksi	MPa \sqrt{m}	ksi \sqrt{in}		
U125-4L3	144	L	3.24	.1275	29.832	11.745	89.23	3.51	44.5	10.0	109.4	24.6	113.3	16.4	*	50.3	C4-2	C4-1
U125-5L2	144	L	3.22	.1266	29.822	11.741	25.17	.99	93.4	21.0	206.0	46.3	214.8	31.1	55.3	61.6	C4-3	C4-1
U125-4L4	144	L	3.22	.1269	29.832	11.745	9.86	.39	146.8	33.0	273.6	61.5	284.5	41.3	67.1	61.6	C4-4	C4-1
															AVG: 61.2	56.0		
U125-6L4	294	L	3.25	.1280	29.807	11.735	80.62	3.17	102.3	23.0	160.8	36.2	166.0	24.1	75.7	68.9	C4-5	C4-2
U125-6L3	294	L	3.22	.1267	29.830	11.744	40.56	1.60	84.5	19.0	195.7	44.0	203.9	29.6	63.5	57.8	C4-6	C4-2
U125-1L16	294	L	3.23	.1270	29.835	11.746	13.28	.52	133.4	30.0	315.4	70.9	327.7	47.5	79.7	72.5	C4-7	C4-2
															AVG: 73.0	66.4		
U125-4L1	450	L	3.23	.1272	29.830	11.744	99.29	3.91	75.6	17.0	199.7	44.9	207.3	30.1	**		C4-8	C4-4
U125-6L5	450	L	3.27	.1287	29.815	11.738	83.34	3.28	97.9	22.0	243.5	54.7	249.3	36.2	**		C4-9	C4-4
U125-3L1	450	L	3.20	.1261	29.802	11.733	64.01	2.52	124.6	28.0	262.9	59.1	275.5	39.9	HSY			
U125-6T7	144	T	3.24	.1277	29.820	11.740	88.98	3.50	31.1	7.0	78.6	17.7	81.3	11.8	**		**	**
U125-3T1	144	T	3.24	.1275	29.855	11.754	25.20	.99	66.7	15.0	159.7	35.9	165.2	24.0	**		**	**
U125-4T1	144	F	3.24	.1275	29.850	11.752	12.55	.49	102.3	23.0	201.3	45.2	208.2	30.2	**		**	**
U125-4T6	294	T	3.25	.1278	29.909	11.775	82.27	3.24	66.7	15.0	107.9	24.2	111.1	16.1	47.4	43.1	C4-10	C4-3
U125-2T1	294	T	3.27	.1289	29.820	11.740	41.40	1.63	62.3	14.0	147.2	33.1	150.8	21.9	**		**	**
U125-5T6	294	T	3.25	.1280	29.845	11.750	12.47	.49	106.8	24.0	243.8	54.8	251.3	36.4	AVG: 47.4	43.1		
U125-6T2	450	T	3.25	.1280	29.809	11.736	98.02	3.86	75.6	17.0	184.2	41.4	190.0	27.6	*		C4-11	C4-5
U125-3111	450	T	3.23	.1273	29.827	11.743	69.37	2.73	84.5	19.0	213.3	48.0	221.2	32.1	94.6	88.8	C4-12	C4-5
U125-6T4	450	T	3.25	.1278	29.809	11.736	53.16	2.09	57.8	13.0	238.9	53.7	246.9	35.8	AVG: 94.6	88.8	C4-13	C4-5

- * Crack resolution near instability lost due to excessive buckling out of the focal plane of the movie camera.
** Crack extension not measurable due to poor resolution on 16mm film.

TABLE C4-2

SPECIMEN NUMBER: U125-4L3
 ALLOY: 2024-T861
 ORIENTATION: LONGITUDINAL
 CONSTRAINT: UNSTIFFENED
 TEST TEMPERATURE: 144.0 K
 SPECIMEN THICKNESS: 3.24 MM (.128 IN)
 K (MAX) DURING PRECRACKING: 18.25 MPA SQRT(M) (16.61 KSI SQRT(IN))

LOAD		A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS		STRESS	
KN	KIPS	MM	IN	MM	IN	MPA SQRT(M)	KSI SQRT(IN)	MPA	KSI	MPA	KSI
25.8	5.8	44.62	1.756	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
70.3	15.8	44.62	1.757	1.00	0.04	10.59	9.64	26.71	3.87	38.11	5.53
81.4	18.3	45.85	1.805	1.24	0.05	23.34	26.70	72.76	10.55	105.05	15.23
93.5	21.0	46.75	1.861	2.14	0.08	34.43	31.31	84.27	12.22	122.74	17.80
34.1	7.6	47.58	1.873	2.96	0.12	39.53	35.98	95.78	13.89	140.64	20.40
		53.77	2.116	8.71	0.34	54.71	55.23	87.03	12.62	135.45	19.64

TABLE C4-3

SPECIMEN NUMBER: U125-5L2
 ALLOY: 2024-T861
 ORIENTATION: LONGITUDINAL
 CONSTRAINT: UNSTIFFENED
 TEST TEMPERATURE: 144.0 K
 SPECIMEN THICKNESS: 2.22 MM (.127 IN)
 K (MAX) DURING PRECRACKING: 19.45 MPA SQRT(M) (17.7 KSI SQRT(IN))

LOAD		A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS		STRESS	
KN	KIPS	MM	IN	MM	IN	MPA SQRT(M)	KSI SQRT(IN)	MPA	KSI	MPA	KSI
168.1	37.8	17.59	.695	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
191.7	43.1	14.23	.560	0.04	0.01	27.24	23.93	175.36	25.43	193.96	28.11
202.3	45.6	16.37	.638	0.20	0.01	44.96	40.91	193.96	29.00	223.77	32.45
204.2	45.9	17.95	.707	0.30	0.01	50.64	46.12	211.55	30.68	240.49	34.88
		21.79	.858	8.81	0.35	55.49	51.51	212.94	30.88	248.02	35.97

TABLE C4-4

SPECIMEN NUMBER: U125-4L4
ALLOY: 2124-T861
ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 144.5 K
SPECIMEN THICKNESS: 3.22 MM (.127 IN)
K(MAX) DURING PRECRACKING: 19.01 MPA SQRT(M) (17.31 KSI SQRT(IN))

KN	LOAD KIPS	A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS		STRESS	
		MM	IN	MM	IN	MPA SQRT(M)	KSI SQRT(IN)	MPA	KSI	MPA	KSI
0.0	0.0	4.93	.194	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
262.0	59.0	16.73	.658	0.40	.016	59.17	53.84	273.44	39.65	303.39	44.00
267.0	61.0	16.50	.649	10.58	.416	61.87	55.31	278.52	40.39	310.83	45.00
276.0	63.0	18.27	.719	17.32	.682	68.12	61.91	291.30	46.79	323.97	46.69

TABLE C4-5

SPECIMEN NUMBER: U125-EL4
ALLOY: 2024-T861
ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 294.0 K
SPECIMEN THICKNESS: 3.25 MM (.128 IN)
K(MAX) DURING PRECRACKING: 39.76 MPA SQRT(M) (35.82 KSI SQRT(IN))

KN	LOAD KIPS	A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS		STRESS	
		MM	IN	MM	IN	MPA SQRT(M)	KSI SQRT(IN)	MPA	KSI	MPA	KSI
0.0	0.0	4.00	.157	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
111.0	25.0	4.00	.157	1.00	.039	43.95	39.30	114.77	16.64	161.00	23.21
134.0	30.0	4.00	.157	1.00	.039	54.15	49.23	139.10	20.17	196.00	28.40
155.0	35.0	4.00	.157	1.00	.039	65.86	59.93	160.68	23.30	223.00	32.00
159.0	36.0	4.00	.157	1.00	.039	68.35	62.20	164.35	23.83	228.00	32.80
154.0	35.0	4.00	.157	14.51	.575	74.81	68.08	164.81	23.90	228.00	32.80

TABLE C4-6

SPECIMEN NUMBER: U125-6L3
ALLOY: 2024-T861
ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 294.0 K
SPECIMEN THICKNESS: 3.22 MM (.127 IN)
K (MAX) DURING PRECRACKING: 22.48 MPA SORT(M) (20.45 KSI SORT(IN))

KN	LOAD KIPS	A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS		STRESS	
		MM	IN	MM	IN	MPA SORT(M)	KSI SORT(IN)	MPA	KSI	MPA	KSI
0.0	0.0	20.28	.798	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00
134.3	30.2	23.60	.929	3.32	.131	38.70	35.22	139.96	20.30	166.82	24.11
156.6	35.2	26.82	.977	4.54	.179	46.34	42.17	163.13	23.66	195.70	28.38
187.3	42.1	28.79	1.055	6.51	.256	57.74	52.55	195.11	28.29	237.90	34.49
193.9	44.1	28.78	1.133	8.53	.334	62.84	56.46	201.59	29.23	249.79	36.22
194.8	44.3	29.61	1.166	9.75	.387	63.45	57.75	202.98	29.44	253.27	36.73

TABLE C4-7

SPECIMEN NUMBER: U125-1L16
ALLOY: 2024-T861
ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 294.0 K
SPECIMEN THICKNESS: 3.23 MM (.127 IN)
K (MAX) DURING PRECRACKING: 23.05 MPA SORT(M) (18.25 KSI SORT(IN))

KN	LOAD KIPS	A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS		STRESS	
		MM	IN	MM	IN	MPA SORT(M)	KSI SORT(IN)	MPA	KSI	MPA	KSI
0.0	0.0	4.64	.251	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00
29.1	6.5	11.23	.442	4.58	.181	57.14	52.03	301.24	43.98	327.92	47.55
30.9	6.9	16.94	.628	8.30	.326	72.41	65.89	321.27	46.39	369.71	53.16
31.1	6.9	18.95	.743	12.22	.481	79.43	72.28	323.12	46.86	369.80	53.16
313.2	70.4	21.44	.844	14.33	.563	85.55	77.85	325.43	47.19	380.07	55.12

TABLE C4-8

SPECIMEN NUMBER: U125-4L1
 ALLOY: 2024-T861
 ORIENTATION: LONGITUDINAL
 CONSTRAINT: UNSTIFFENED
 TEST TEMPERATURE: 453.0 K
 SPECIMEN THICKNESS: 3.23 MM (.127 IN)
 K (MAX) DURING PRECRACKING: 33.29 MPA SORT (M) (30.30 KSI SORT (IN))

LOAD		A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS	
KN	KIPS	MM	IN	MM	IN	MPA SORT (M)	KSI SORT (IN)	FULL SECTION MPA	NET SECTION KSI
170.4	38.0	50.64	1.994	0.00	2.000	0.00	0.00	0.00	0.00
189.4	42.3	52.84	2.080	3.19	.126	78.16	71.13	176.80	25.64
193.9	43.6	56.47	2.211	5.76	.227	89.58	81.52	196.19	28.45
197.1	44.3	57.29	2.256	7.66	.301	94.09	85.62	201.26	29.19
198.4	44.6	59.25	2.333	9.61	.378	97.33	89.12	204.49	29.66
		61.48	2.421	11.84	.466	101.30	92.19	205.88	29.85

TABLE C4-9

SPECIMEN NUMBER: U125-3L1
 ALLOY: 2024-T861
 ORIENTATION: LONGITUDINAL
 CONSTRAINT: UNSTIFFENED
 TEST TEMPERATURE: 450.0 K
 SPECIMEN THICKNESS: 3.20 MM (.125 IN)
 K (MAX) DURING PRECRACKING: 42.59 MPA SORT (M) (38.76 KSI SORT (IN))

LOAD		A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS	
KN	KIPS	MM	IN	MM	IN	MPA SORT (M)	KSI SORT (IN)	FULL SECTION MPA	NET SECTION KSI
181.5	40.8	32.00	1.260	0.00	0.000	0.00	0.00	0.00	0.00
235.8	52.8	37.04	1.458	1.93	.076	64.14	58.37	190.16	27.58
247.3	55.6	38.60	1.520	4.68	.184	87.13	79.29	247.02	35.82
258.0	57.8	39.10	1.539	7.39	.270	94.87	86.33	259.14	37.58
		42.91	1.696	10.81	.426			270.32	39.20

TABLE C4-10

SPECIMEN NUMBER: U125-4T6
ALLOY: 2024-T861
ORIENTATION: TRANSVERSE
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 450. J K
SPECIMEN THICKNESS: 3.25 MM (0.128 IN)
K (MAX) DURING PRECRACKING: 25.93 MPa SQRT(M) (23.59 KSI SQRT(IN))

LOAD KN	KIPS	A, HALF CRACK LENGTH		DELTA A		STRESS MPa	INTENSITY SQRT(M)	KSI	SQRT(IN)	STRESS		FULL SECTION MPa	KSI	NET SECTION	
		MM	IN	MM	IN					MPa	KSI			MPa	KSI
0.0	0.0	41.14	1.619	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9.0	2.0	42.14	1.660	1.04	0.041	38.95	35.45	35.45	101.74	14.75	14.75	141.69	20.95	20.95	20.95
10.0	2.2	44.14	1.728	2.71	0.107	43.42	36.79	36.79	103.10	14.95	14.95	145.87	21.15	21.15	21.15
10.0	2.2	45.14	1.817	5.11	0.201	43.42	39.15	39.15	106.31	15.42	15.42	153.75	22.30	22.30	22.30
10.0	2.2	51.22	2.017	13.09	0.397	47.49	43.14	43.14	109.52	15.88	15.88	166.58	24.16	24.16	24.16

TABLE C4-11

SPECIMEN NUMBER: U125-6T2
ALLOY: 2024-T861
ORIENTATION: TRANSVERSE
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 450. J K
SPECIMEN THICKNESS: 3.25 MM (0.128 IN)
K (MAX) DURING PRECRACKING: 32.83 MPa SQRT(M) (29.88 KSI SQRT(IN))

LOAD KN	KIPS	A, HALF CRACK LENGTH		DELTA A		STRESS MPa	INTENSITY SQRT(M)	KSI	SQRT(IN)	STRESS		FULL SECTION MPa	KSI	NET SECTION	
		MM	IN	MM	IN					MPa	KSI			MPa	KSI
0.0	0.0	40.21	1.583	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9.0	2.0	40.30	1.594	1.34	0.053	43.85	39.91	39.91	102.74	15.24	15.24	155.10	22.49	22.49	22.49
10.0	2.2	40.30	1.594	1.34	0.053	61.34	55.81	55.81	124.20	20.64	20.64	215.90	31.43	31.43	31.43
10.0	2.2	40.30	1.594	6.29	0.169	74.52	67.81	67.81	157.90	24.30	24.30	250.82	35.74	35.74	35.74
10.0	2.2	40.30	1.594	6.81	0.268	84.29	76.71	76.71	183.62	26.64	26.64	291.55	41.74	41.74	41.74
10.0	2.2	40.30	1.594	9.81	0.385	90.09	81.93	81.93	189.13	27.43	27.43	312.46	44.74	44.74	44.74

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SPECIMEN NUMBER: U125-3T11
ALLOY: 2024-T361
ORIENTATION: TRANSVERSE
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 453 °K
SPECIMEN THICKNESS: 3.23 MM (0.127 IN)
K (MAX) DURING PRECRACKING: 29.97 MPA SQRT(M) (27.24 KSI SQRT(IN))

[illegible]

TABLE C4-13

SPECIMEN NUMBER: U125-ET4
 ALLOY: 2024-T861
 ORIENTATION: TRANSVERSE
 CONSTRAINT: UNSTIFFENED
 TEST TEMPERATURE: 450.0 K
 SPECIMEN THICKNESS: 3.25 MM (.129 IN)
 V (MAX) DURING PRECRACKING: 17.62 MPA SQRT(M) (15.93 KSI SQRT(IN))

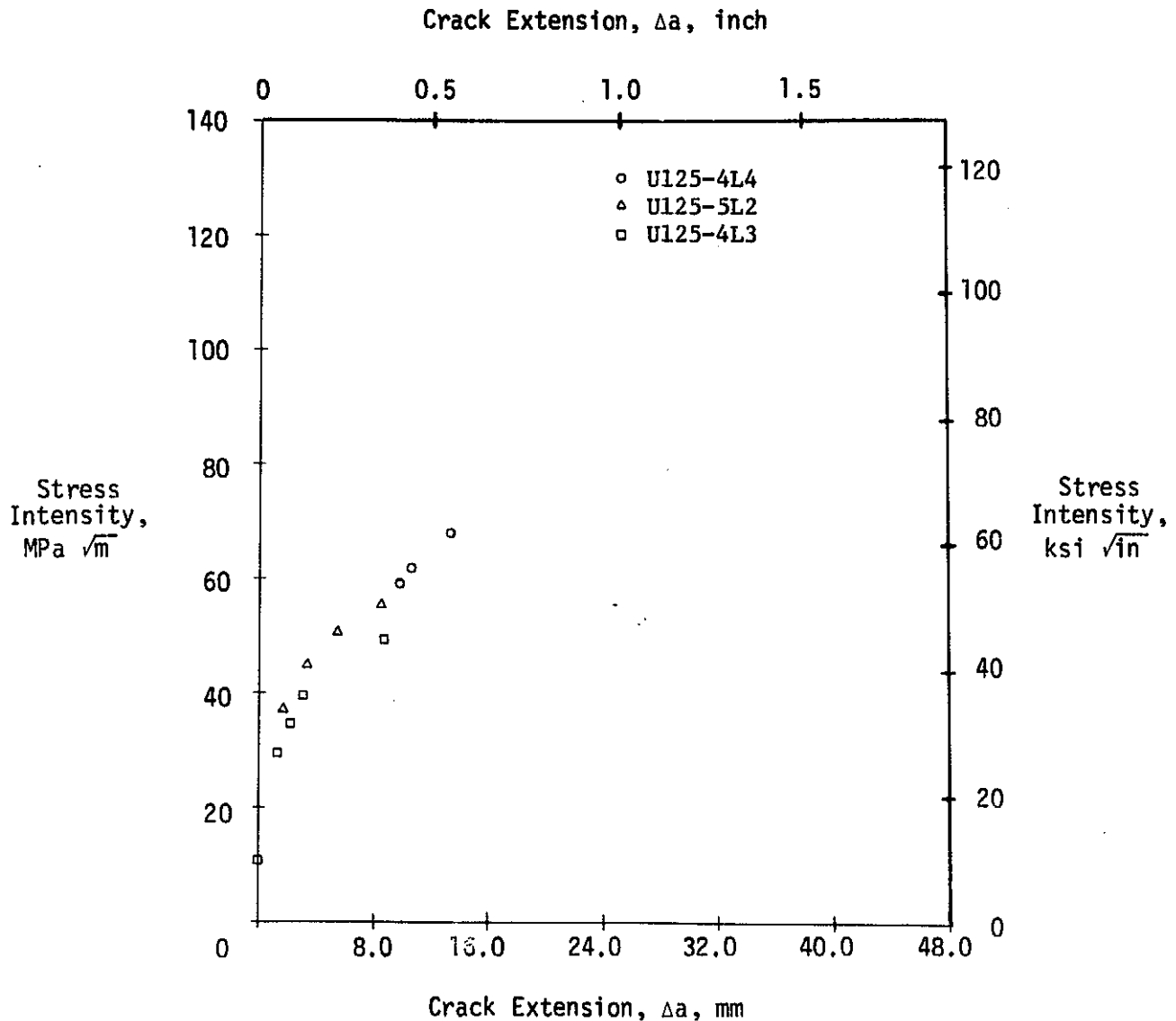
LOAD		A HALF CRACK LENGTH	DELTA A	STRESS INTENSITY	STRESS		NET SECTION		
KN	KT/PS	MM	IN	MPA	SQRT(M)	KSI	SQRT(IN)	MPA	KSI
320	72.1	3.5	0.137	60.48	60.54	224.36	32.54	273.67	39.59
325	73.3	3.5	0.141	71.45	71.45	230.34	33.40	284.70	41.29
335	75.3	3.5	0.153	77.23	77.23	243.21	35.27	305.69	44.33

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FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 3.18 mm (.125 inch)

Orientation: Longitudinal

Temperature: 144°K (-200°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

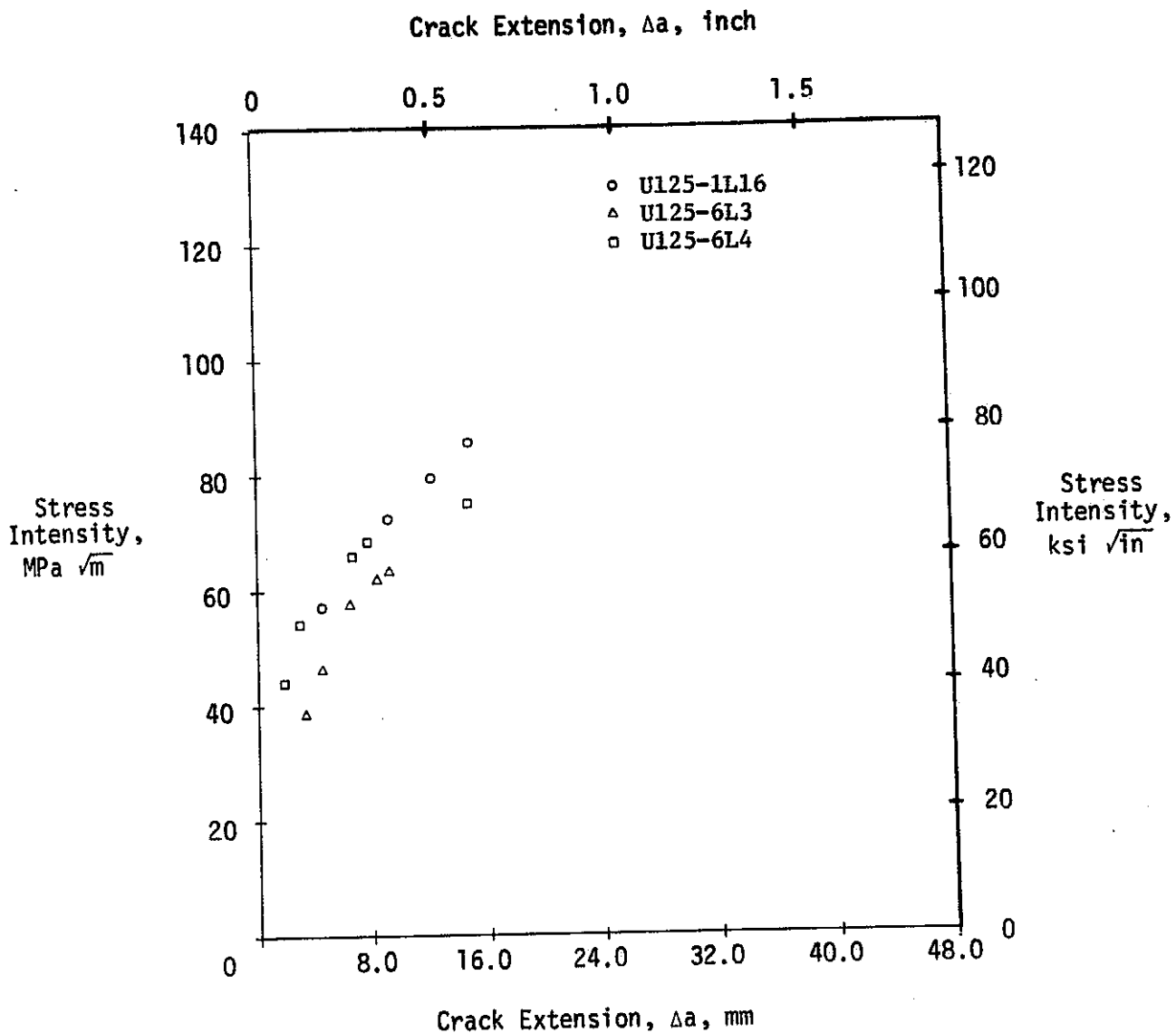
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FIGURE C4-1

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 3.18 mm (.125 inch)

Orientation: Longitudinal

Temperature: 298°K (70°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

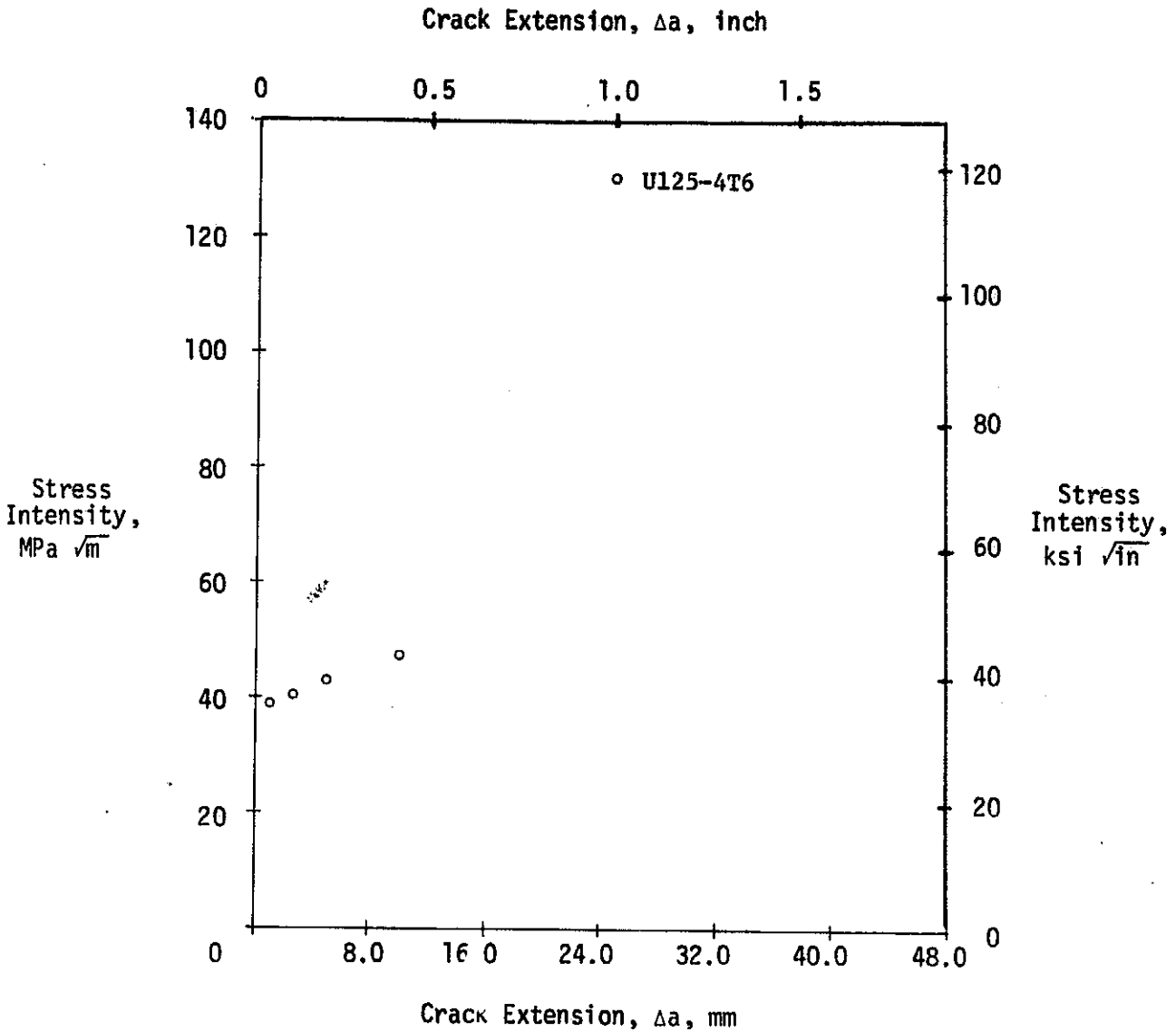
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FIGURE C4-2

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 3.18 mm (.125 inch)

Orientation: Transverse

Temperature: 298°K (70°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

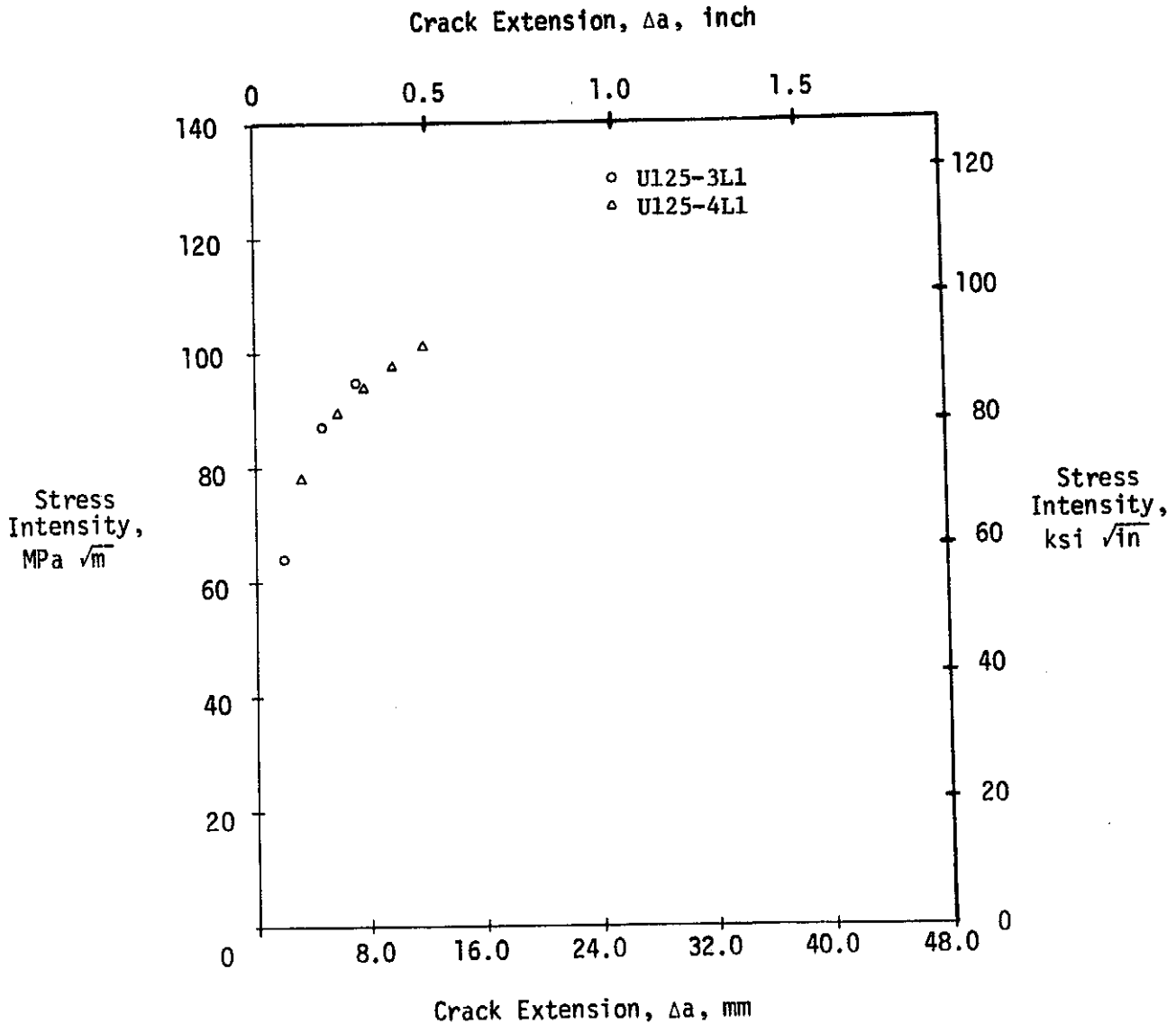
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FIGURE C4-3

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 3.18 mm (.125 inch)

Orientation: Transverse

Temperature: 450°K (350°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

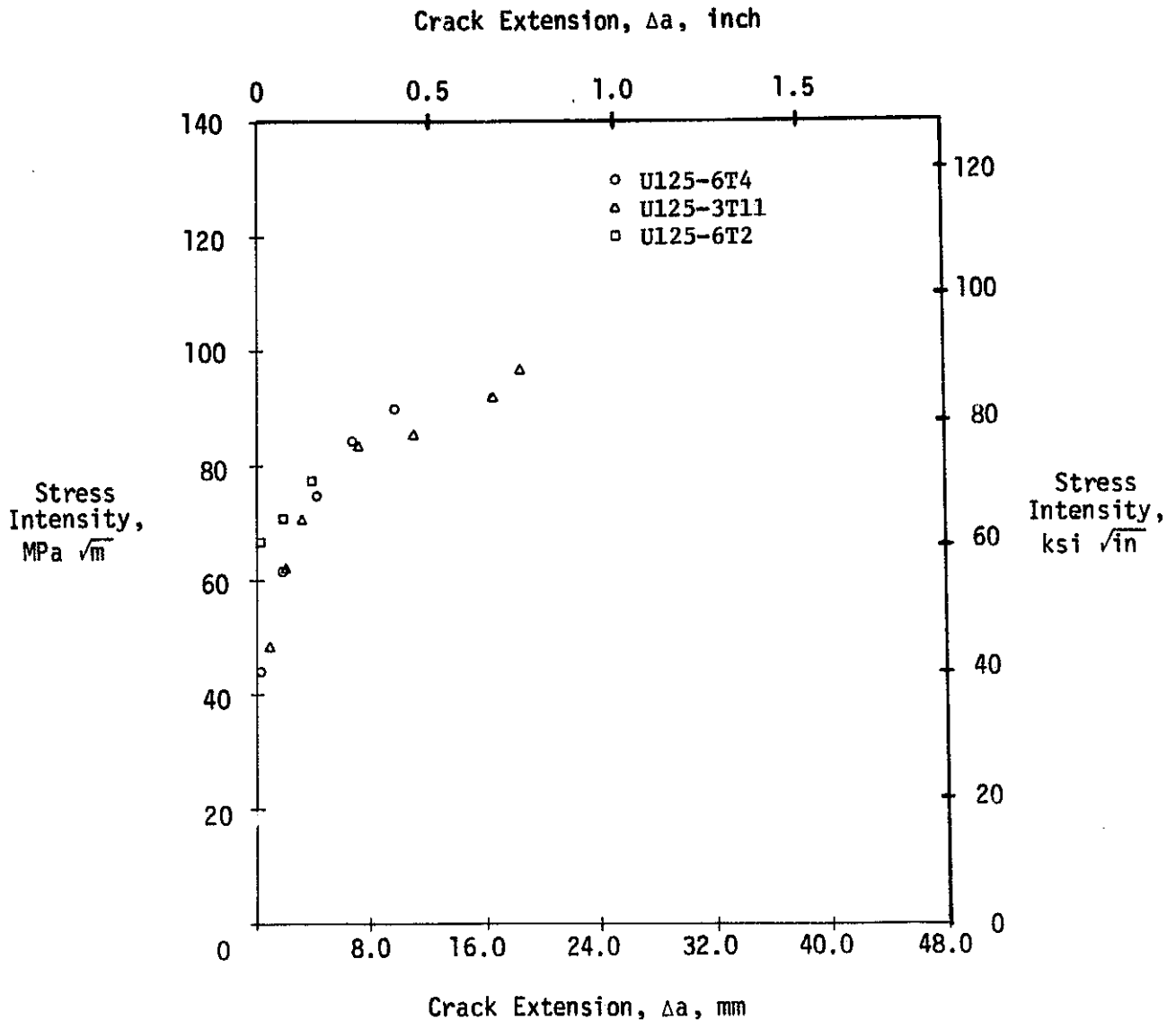
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FIGURE C4-4

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 3.18 mm (.125 inch)

Orientation: Longitudinal

Temperature: 450°K (350°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974

SECTION C5. FRACTURE TOUGHNESS TEST DATA FOR 6.35 mm
(.250 INCH) THICK 2024-T861

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MCDONNELL DOUGLAS AERONAUTICS COMPANY - EAST

FINAL REPORT

MDC E1153
October 1974

TABLE C5-1.
Fracture Toughness Test Data for 2024-T861 Specimens
(6.35 mm (.250 inch) thick)

Specimen Number	Temperature (K)	Orientation	Specimen Dimensions				Precrack Length		Precrack Load		Failure Load		Full Section Failure Stress		Critical Stress Intensity, K_{IC} MPa√m	Stress K_{IC} ksi√in	Data Table No.	Figure No.
			Thickness mm	in	cm	in	mm	in	Kn	kip	Kn	kip	MPa	ksi				
250-2L4	144	L	6.47	.2548	29.797	11.731	88.32	3.48	62.3	14.0	154.8	34.8	80.3	11.6	35.1	32.0	C5-2	C5-1
250-2L3	144	L	6.36	.2503	29.815	11.738	25.07	.99	222.4	50.0	295.4	66.4	155.8	22.6	38.9	35.4	C5-3	C5-1
250-1L2	144	L	6.33	.2493	29.802	11.733	10.62	.42	231.3	52.0	392.6	88.2	208.0	30.2	35.4	33.2	C5-4	C5-1
													AVG:	36.5				
250-3L6	294	L	6.19	.2436	29.807	11.735	82.50	3.25	84.5	19.0	192.4	43.2	104.3	15.1	43.6	39.7	C5-5	C5-3
250-3L4	294	L	6.25	.2460	29.766	11.719	28.93	1.14	177.9	40.0	290.0	65.2	156.0	22.6	42.1	38.4	C5-6	C5-3
250-4L1	294	L	6.40	.2520	29.802	11.733	10.03	.39	244.7	55.0	509.3	114.5	267.0	38.7	45.4	46.3	C5-7	C5-3
													AVG:	43.7		39.8		
250-3L8	450	L	6.18	.2433	29.827	11.743	81.99	3.23	111.2	25.0	347.0	78.0	188.3	27.3	95.9	87.2	C5-8	C5-5
250-3L10	450	L	6.14	.2417	29.812	11.737	50.37	1.98	177.9	40.0	438.1	98.5	239.4	34.7	96.4	87.8	C5-9	C5-5
250-3L12	450	L	6.33	.2493	29.794	11.730	30.84	1.21	146.8	33.0	487.1	109.5	258.2	37.4	89.0	81.0	C5-10	C5-5
													AVG:	93.8		85.3		
250-1T4	144	T	6.36	.2502	29.802	11.733	88.62	3.49	57.8	13.0	129.0	29.0	68.1	9.9	30.7	28.0	C5-11	C5-2
250-3T1	144	T	6.14	.2417	29.802	11.733	25.93	1.02	186.8	42.0	214.8	48.3	117.4	17.0	28.3	25.7	C5-12	C5-2
250-1T2	144	T	6.37	.2507	29.822	11.741	10.74	.42	195.7	44.0	357.0	80.2	188.0	27.3	32.1	29.3	C5-13	C5-2
													AVG:	30.4		27.7		
250-2T8	294	T	6.39	.2515	29.820	11.740	81.94	3.23	71.2	16.0	154.4	34.7	81.0	11.8	32.5	29.6	C5-14	C5-4
250-2T7	294	T	6.38	.2510	29.830	11.744	30.38	1.20	177.9	40.0	248.2	55.8	130.5	18.9	32.9	29.9	C5-15	C5-4
250-1T6	294	T	6.33	.2494	29.782	11.725	9.68	.38	209.1	47.0	399.2	89.7	211.6	30.7	35.7	32.5	C5-16	C5-4
													AVG:	33.7		30.7		
250-2T3	450	T	6.40	.2518	29.787	11.727	83.13	3.27	111.2	25.0	290.2	65.2	152.4	22.1	68.3	61.4	C5-17	C5-6
250-2T12	450	T	6.36	.2505	29.789	11.728	37.80	1.49	177.9	40.0	371.4	83.5	196.0	28.4	75.7	68.9	C5-18	C5-6
250-4T5	450	T	6.28	.2473	29.840	11.748	17.37	.68	186.8	42.0	518.2	116.5	276.5	40.1	67.9	61.8	C5-19	C5-6
													AVG:	70.6		64.0		

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TABLE C5-2

SPECIMEN NUMBER:	25J-2L4
ALLOY:	2024-T861
ORIENTATION:	LONGITUDINAL
CONSTRAINT:	UNSTIFFED
TEST TEMPERATURE:	144.0 K
SPECIMEN THICKNESS:	6.47 MM (0.255 IN)
K (MAX) DURING PRECRACKING:	12.72 MPA SQRT (M) (11.54 KSI SQRT (IN))

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TABLE C5-3

SPECIMEN NUMBER:	250-2L3
ALLOY:	2024-T361
ORIENTATION:	LONGITUDINAL
CONSTRAINT:	UNSTIFFENED
TEST TEMPERATURE:	144.0 K
SPECIMEN THICKNESS:	6.36 MM (0.25 IN)
K (MAX) DURING PRECRACKING:	23.39 MPA SQRT (M) (21.28 KSI SQRT (IN))

KN	LOAD KIPS	COD		A HALF CRACK MM	LENGTH IN	DELTA A		STRESS MPA	STRESS SQRT(H)	INTENSITY KSI	INTENSITY SQRT(IN)	STRESS FULL SECTION		STRESS NET SECTION	
		E-3 MM	E-3 IN			MM	IN					MPA	KSI	MPA	KSI
1	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
2	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
3	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
4	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
5	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
6	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
7	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
8	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
9	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
10	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
11	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
12	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
13	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
14	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
15	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
16	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
17	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
18	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
19	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
20	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
21	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
22	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
23	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
24	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
25	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
26	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
27	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
28	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
29	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
30	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
31	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
32	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
33	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
34	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		
35	32.7			12.5	.433			15.0	1.08	10.00	0.03	10.00	0.00		

TABLE C5-4

SPECIMEN NUMBER: 250-1L2
 ALLOY: 2024-T861
 ORIENTATION: LONGITUDINAL
 CONSTRAINT: UNSTIFFENED
 TEST TEMPERATURE: 144.0 K
 SPECIMEN THICKNESS: 6.33 MM (1.249 IN)
 K (MAX) DURING PRECRACKING: 15.84 MPA SQRT(M) (14.42 KSI SQRT(IN))

KN	LOAD KIPS	COD		A, HALF CRACK LENGTH MM	IN	DELTA A MM	IN	STRESS MPA SQRT(IN)	INTENSITY KSI SQRT(IN)	STRESS		FULL SECTION MPA	KSI	STRESS		NET SECTION MPA	KSI
		E-3 MM	E-3 IN							MPA	KSI			MPA	KSI		
0.0	0.0	4.00	0.00	5.31	.209	0.60	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.0	2.2	21.47	0.85	5.66	.222	0.69	0.033	0.63	0.63	72.75	13.45	72.75	13.45	75.49	13.95	10.95	10.95
20.0	4.4	32.85	1.28	5.95	.233	0.74	0.066	1.16	1.16	93.67	16.95	93.67	16.95	97.22	17.60	14.10	14.10
30.0	6.6	35.17	1.38	5.96	.233	0.74	0.066	1.16	1.16	109.55	19.95	109.55	19.95	109.72	19.91	15.91	15.91
40.0	8.8	42.88	1.69	5.96	.233	0.74	0.066	1.16	1.16	114.84	19.95	114.84	19.95	114.84	19.95	16.60	16.60
50.0	11.0	47.87	1.88	5.96	.233	0.74	0.066	1.16	1.16	120.65	17.56	120.65	17.56	125.59	18.21	18.21	18.21
60.0	13.2	51.00	2.01	5.96	.233	0.74	0.066	1.16	1.16	136.61	18.94	136.61	18.94	136.61	19.72	19.72	19.72
70.0	15.4	58.28	2.29	5.96	.233	0.74	0.066	1.16	1.16	147.93	20.57	147.93	20.57	147.93	21.44	21.44	21.44
80.0	17.6	62.86	2.47	5.96	.233	0.74	0.066	1.16	1.16	166.09	22.45	166.09	22.45	174.31	22.95	22.95	22.95
90.0	19.8	65.39	2.57	5.96	.233	0.74	0.066	1.16	1.16	177.49	25.76	177.49	25.76	185.25	26.66	26.66	26.66
100.0	22.0	67.67	2.66	5.96	.233	0.74	0.066	1.16	1.16	188.67	26.23	188.67	26.23	188.67	27.37	27.37	27.37
110.0	24.2	70.79	2.79	5.96	.233	0.74	0.066	1.16	1.16	185.81	26.95	185.81	26.95	194.14	27.95	27.95	27.95
120.0	26.4	81.12	3.15	5.96	.233	0.74	0.066	1.16	1.16	185.81	27.31	185.81	27.31	197.05	28.46	28.46	28.46
130.0	28.6	83.24	3.28	5.96	.233	0.74	0.066	1.16	1.16	193.34	28.87	193.34	28.87	200.00	29.83	29.83	29.83
140.0	30.8	88.06	3.47	5.96	.233	0.74	0.066	1.16	1.16	197.38	28.62	197.38	28.62	200.00	29.83	29.83	29.83
150.0	33.0	95.42	3.75	5.96	.233	0.74	0.066	1.16	1.16	199.36	28.96	199.36	28.96	200.00	29.83	29.83	29.83
160.0	35.2	104.86	4.10	5.96	.233	0.74	0.066	1.16	1.16	202.22	28.88	202.22	28.88	200.00	29.83	29.83	29.83
170.0	37.4	117.87	4.63	5.96	.233	0.74	0.066	1.16	1.16	206.77	29.97	206.77	29.97	200.00	29.83	29.83	29.83
180.0	39.6	115.54	4.54	5.96	.233	0.74	0.066	1.16	1.16	208.69	29.77	208.69	29.77	200.00	29.83	29.83	29.83
190.0	41.8	115.78	4.56	5.96	.233	0.74	0.066	1.16	1.16	208.69	29.77	208.69	29.77	200.00	29.83	29.83	29.83
200.0	44.0	117.86	4.61	5.96	.233	0.74	0.066	1.16	1.16	208.69	29.77	208.69	29.77	200.00	29.83	29.83	29.83

```

SPECIMEN NUMBER: 250-3L5
ALLOY: 2024-T361
ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFED
TEST TEMPERATURE: 294.2 K
SPECIMEN THICKNESS: 6.19 MM (.244 IN)
K (MAX) DURING PRECRACKING: 17.32 MPa SQRT(M) ( 15.75 KSI SQRT(INK))

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[illegible]

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SPECIMEN NUMBER: 25J-3L4
ALLOY: 2024-T861
ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 294.0 K
SPECIMEN THICKNESS: 6.25 MM ( 1/4 IN )
<MAX> DURING PRECRACKING: 20.51 MPA SQRT(M) ( 14.67 KSI SQRT(IN) )

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[illegible]

TABLE C5-8

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SPECIMEN NUMBER: 251-31A
ALLOY: 2024-T861
ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 450.0 K
SPECIMEN THICKNESS: 6.18 MM (.243 IN)
K (MAX) CURING PRECRACKING: 22.72 MPa SQRT(M) ( 20.69 KSI SQRT(IN))

```

LOAD		COR		A. HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS					
KN	KIPS	E-3	44	E-3	IN	44	IN	MPA	SQRT(M)	INTENSITY KSI	SQRT(IN)	FULL SECTION MPA	SECTION KSI	NET SECTION MPA	SECTION KSI
0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
145.9	32.8	21.39	0.00	41.36	1.614	0.36	0.014	29.96	27.26	79.14	11.48	109.51	15.88		
184.3	41.4	28.54	11.12	41.97	1.653	0.98	0.039	38.19	34.75	100.00	14.59	139.16	20.18		
213.0	47.3	34.39	15.06	43.10	1.697	2.15	0.083	44.84	40.81	115.55	16.76	162.51	23.57		
244.7	55.1	40.16	15.67	43.72	1.721	2.73	0.107	51.98	47.32	132.76	19.25	187.83	27.24		
274.0	61.0	46.10	18.43	44.55	1.754	3.55	0.143	58.87	53.58	148.65	21.56	211.96	30.74		
298.9	67.2	54.27	18.16	46.12	1.816	5.12	0.202	65.64	59.74	162.21	23.82	234.82	34.05		
316.0	71.3	60.15	23.82	47.93	1.886	8.91	0.272	71.08	64.69	171.46	24.96	252.59	36.63		
327.6	73.6	65.82	25.62	49.12	1.933	8.53	0.316	74.79	68.86	177.4	25.77	264.77	38.40		
339.1	76.2	72.14	24.55	51.55	2.030	13.57	0.416	80.33	72.83	184.00	26.68	281.24	40.79		
346.4	77.3	78.54	31.11	53.7	2.117	12.78	0.503	84.08	76.52	187.95	27.26	293.94	42.63		
350.0	78.7	83.43	32.80	55.61	2.180	14.62	0.576	86.95	79.13	189.92	27.54	302.86	43.92		
350.0	78.7	88.17	34.07	58.09	2.287	17.09	0.673	89.65	81.58	189.90	27.54	311.95	45.11		
351.8	79.1	95.24	37.61	60.81	2.394	17.81	0.730	93.15	84.77	193.86	27.63	322.25	46.77		

27.84 MPA SQRT (M) (25.33 KSI SQRT (IN))

TABLE C5-10

17.24 MPA SQRT(M) (15.69 KSI SQRT(IN))

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TABLE C5-12

SPECIMEN NUMBER: 253-3T1
 ALLOY: 2024-T361
 ORIENTATION: TRANSVERSE
 CONSTRAINT: UNSTIFFENED
 TEST TEMPERATURE: 144.3 K
 SPECIMEN THICKNESS: 6.14 MM (0.242 IN)
 K (MAX) DURING PRECRACKING: 20.71 MPA SQRT(M) (18.84 KSI SQRT(IN))

LOAD		COD		A HALF CRACK LENGTH		DELTA A		STRESS		STRESS		STRESS			
KN	KIPS	E-3 MM	E-3 IN	MM	IN	MM	IN	MPA	SQRT(M)	INTENSITY KSI	SQRT(IN)	FULL SECTION MPA	SECTION KSI	NET SECTION MPA	SECTION KSI
155.0	35.0	5.3	0.21	12.97	0.510	0.001	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
155.9	35.4	5.3	0.21	12.99	0.511	0.000	0.000	17.24	15.69	94.98	12.32	93.08	13.50	93.08	13.50
176.9	39.7	5.4	0.21	13.05	0.514	0.003	0.000	19.63	17.86	96.50	13.99	95.76	15.34	95.76	15.34
197.1	44.3	5.1	0.20	13.55	0.534	0.023	0.009	22.34	21.33	107.74	15.62	118.52	17.19	118.52	17.19
203.4	45.7	4.7	0.19	14.17	0.559	0.048	0.019	23.59	22.47	111.19	16.12	122.88	17.82	122.88	17.82
218.2	49.3	4.1	0.16	14.92	0.587	0.061	0.024	25.69	22.47	114.93	16.67	127.34	18.47	127.34	18.47
213.6	48.0	4.1	0.16	15.56	0.613	0.099	0.039	25.98	22.67	116.76	16.93	130.37	18.91	130.37	18.91
215.5	48.4	10.8	0.43	16.48	0.649	0.108	0.042	27.00	24.67	117.79	17.13	132.43	19.21	132.43	19.21
215.4	48.4	10.8	0.43	17.91	0.705	0.199	0.079	28.07	25.64	117.73	17.37	133.81	19.40	133.81	19.40
215.7	48.5	13.4	0.53	20.23	0.796	0.26	0.10	30.16	27.35	117.89	17.10	136.41	19.78	136.41	19.78

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SPECIMEN NUMBER: 250-2T8
ALLOY: 2024-T861
ORIENTATION: TRANSVERSE
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 294.0 K
SPECIMEN THICKNESS: 6.39 MM (1.252 IN)
DURING PRECRACKING: 14.0E MPA SORT(M) (12.81 KSI SORT(IN))
K (MAX)

LOAD		CON		4, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		FULL SECTION		NET SECTION	
KN	KIPS	E-3 MM	E-3 IN	MM	IN	MM	IN	MPA	SQRT (N)	KSI	MPA	KSI	KSI
0	0												
87	19.6					0.68	0.033	0.00	0.00		0.00	0.00	0.00
104	23.2					0.81	0.031	17.36	15.80		0.11	0.03	0.03
114	25.6					0.95	0.036	20.71	18.84		0.93	0.09	0.09
126	28.2					1.09	0.039	22.06	20.80		0.26	0.73	0.47
135	30.3					1.23	0.043	25.11	23.03		0.28	0.92	0.60
135	30.3					1.37	0.042	27.11	24.67		0.93	0.99	0.68
141	31.5					1.51	0.059	27.00	24.84		1.19	1.00	0.72
142	31.7					1.65	0.065	29.64	26.35		1.42	1.04	0.74
145	32.2					1.79	0.070	30.88	26.23		1.68	1.06	0.77
150	33.5					1.93	0.077	31.17	26.92		1.96	1.11	0.80
154	34.0					2.07	0.082	32.27	28.17		2.23	1.12	0.82
154	34.0					2.21	0.087	32.59	29.45		2.51	1.13	0.83
154	34.0					2.35	0.094	32.79	30.77		2.79	1.15	0.85
154	34.0					2.49	0.098	32.79	32.09		2.91	1.16	0.86

TABLE C5-17

SPECIMEN NUMBER: 250-2T3
ALLOY: 2024-T861
ORIENTATION: TRANSVERSE
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 450.0 K
SPECIMEN THICKNESS: 6.40 MM (.252 IN)
K (MAX) DURING PRECRACKING: 22.17 MPA SQRT(M) (20.17 KSI SQRT(IN))

LOAD KN	KIPS	COD		A, HALF CRACK LENGTH MM	IN	DELTA A		STRESS MPA	INTENSITY KSI	FULL SECTION MPA	STRESS KSI	NET SECTION MPA	KSI
		E-1 MM	E-1 IN			MM	IN						
0	0	0	0	41.57	1.636	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00
7	1.5	0	0	42.25	1.653	0.69	0.027	14.94	13.59	38.96	5.65	54.38	7.89
14	3.1	0	0	42.64	1.671	0.87	0.034	27.85	25.35	72.44	10.59	101.30	14.69
21	4.7	0	0	43.83	1.724	2.23	0.088	40.51	36.85	103.34	14.99	146.38	21.23
28	6.3	0	0	45.95	1.774	3.49	0.137	51.62	46.98	129.40	18.77	185.53	26.91
35	8.0	0	0	45.25	1.742	3.69	0.145	55.89	50.86	139.70	20.26	208.69	29.80
42	9.6	0	0	46.44	1.828	4.87	0.192	59.45	53.83	145.49	21.40	211.41	30.66
49	11.2	0	0	47.65	1.876	5.13	0.200	62.35	56.65	153.64	21.84	221.51	32.22
56	12.8	0	0	48.13	1.895	5.56	0.219	63.71	57.94	153.21	22.22	226.44	32.82
63	14.4	0	0	49.70	1.957	8.17	0.320	65.18	59.32	153.52	22.26	230.08	33.41
70	16.0	0	0	51.71	2.037	10.17	0.400	67.49	61.42	154.86	22.45	237.19	34.40
77	17.6	0	0	54.85	2.160	13.24	0.523	69.15	62.97	152.53	22.12	241.47	35.02

TABLE C5-18

SPECIMEN NUMBER: 250-2T12
ALLOY: 2024-T861
ORIENTATION: TRANSVERSE
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 450.0 K
SPECIMEN THICKNESS: 6.36 MM (.251 IN)
K (MAX) DURING PRECRACKING: 23.10 MPA SQRT(M) (21.62 KSI SQRT(IN))

LOAD KN	KIPS	COD		A, HALF CRACK LENGTH MM	IN	DELTA A		STRESS MPA	INTENSITY KSI	FULL SECTION MPA	STRESS KSI	NET SECTION MPA	KSI
		E-1 MM	E-1 IN			MM	IN						
0	0	0	0	18.90	.744	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00
53	12.0	0	0	20.18	.794	1.28	0.050	7.24	6.59	28.45	4.13	42.91	6.17
110	24.5	0	0	20.19	.794	6.25	0.248	16.67	15.17	58.28	8.46	70.05	10.16
159	35.5	0	0	21.54	.849	7.58	0.298	24.73	22.50	84.07	12.19	102.25	14.83
198	44.5	0	0	21.72	.857	8.36	0.329	31.30	28.49	104.77	15.19	128.24	18.60
239	53.5	0	0	22.93	.902	11.55	0.455	39.29	35.76	126.12	18.29	157.18	22.27
278	62.0	0	0	23.33	.922	11.62	0.458	46.67	42.47	146.82	20.29	184.66	26.17
307	69.2	0	0	23.33	.922	11.83	0.465	51.77	47.12	162.35	23.31	204.50	29.66
326	73.5	0	0	23.33	.922	12.53	0.495	55.99	50.95	172.06	24.95	218.44	31.73
342	77.0	0	0	23.33	.922	13.30	0.526	60.19	54.78	181.48	26.17	222.57	33.04
364	81.5	0	0	23.33	.922	15.85	0.624	65.69	59.78	193.13	27.86	240.88	35.34
370	83.2	0	0	23.33	.922	17.64	0.694	68.75	62.57	195.38	28.33	247.77	36.54
372	83.5	0	0	23.33	.922	20.20	0.795	71.53	65.10	195.40	28.36	256.44	38.42
372	83.5	0	0	23.33	.922	23.20	0.913	75.27	68.50	196.71	28.53	264.94	40.77

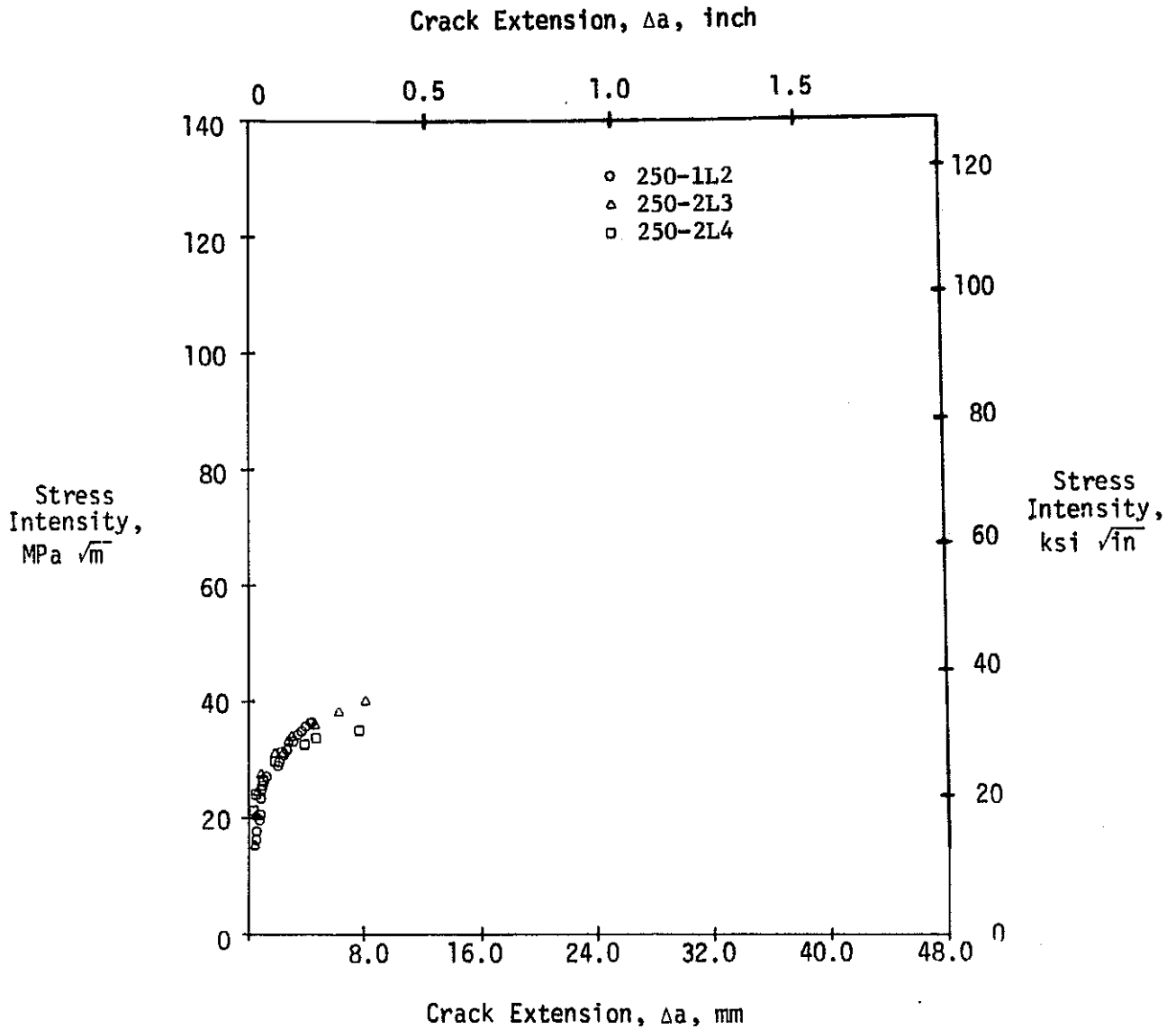
SPECIMEN NUMBER:	250-4T5
ALLOY:	2024-T861
ORIENTATION:	TRANSVERSE
CONSTRAINT:	UNSTIFFENED
TEST TEMPERATURE:	453.0 K
SPECIMEN THICKNESS:	6.28 MM (0.247 IN)
K (MAX) DURING PRE CRACKING:	16.50 MPA SQRT(M) (15.02 KS SQRT(IN))

[illegible]

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 6.36 mm (.250 inch)

Orientation: Longitudinal

Temperature: 144°K (-200°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

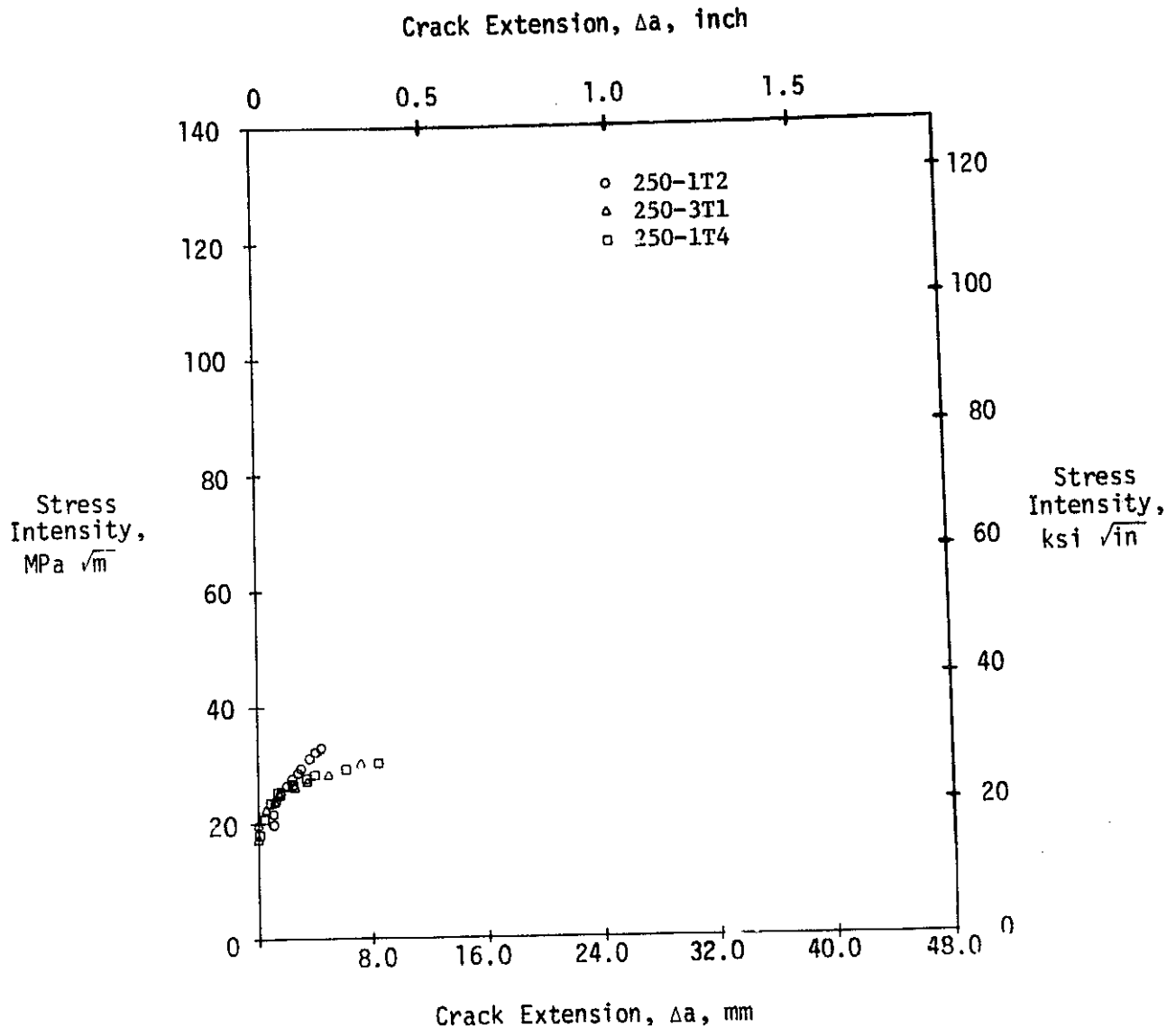
C-77

FIGURE C5-1

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 6.35 mm (.250 inch)

Orientation: Transverse

Temperature: 144°K (-200°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

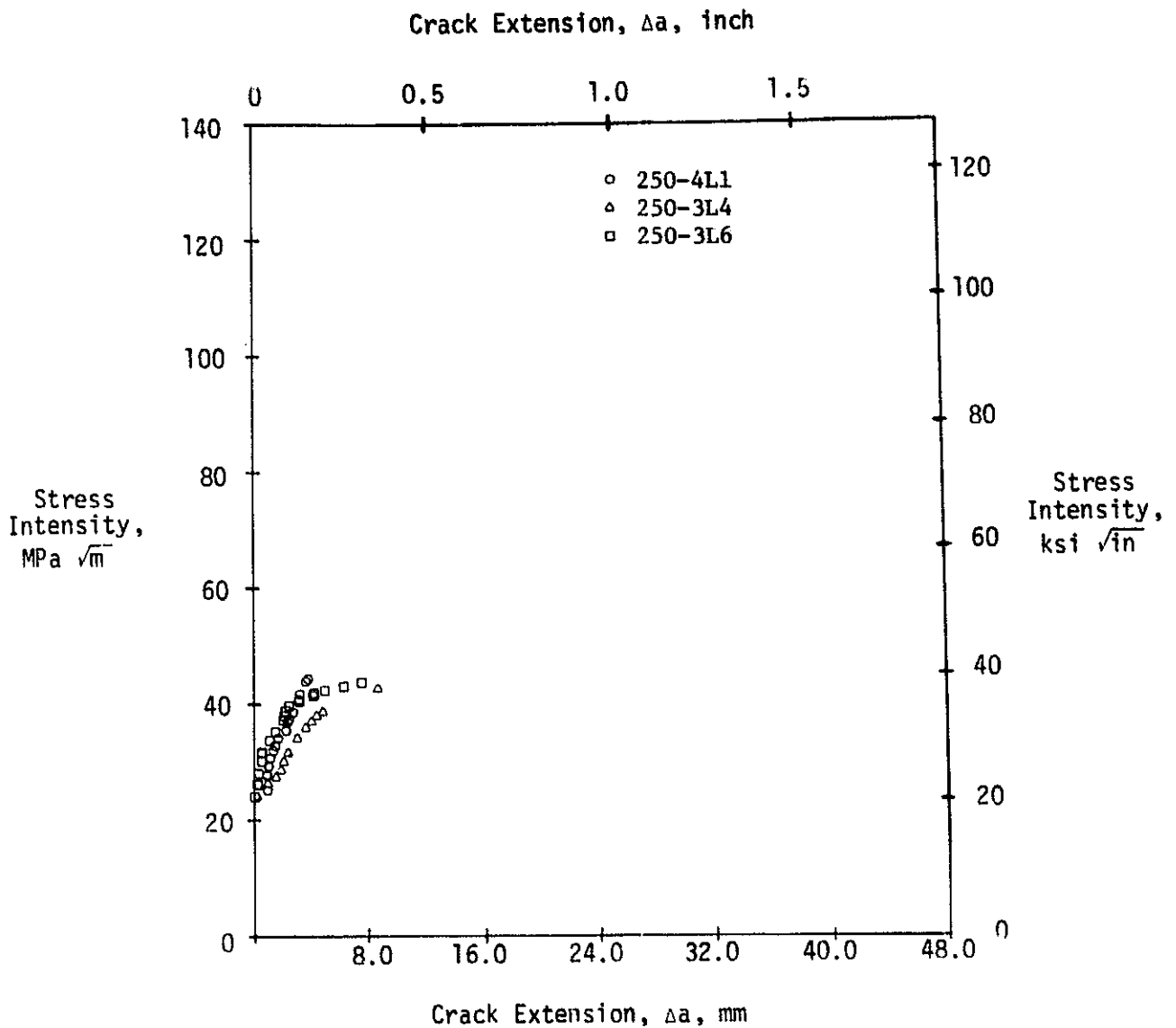
C-78

FIGURE C5-2

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness. 6.35 mm (.250 inch)

Orientation: Longitudinal

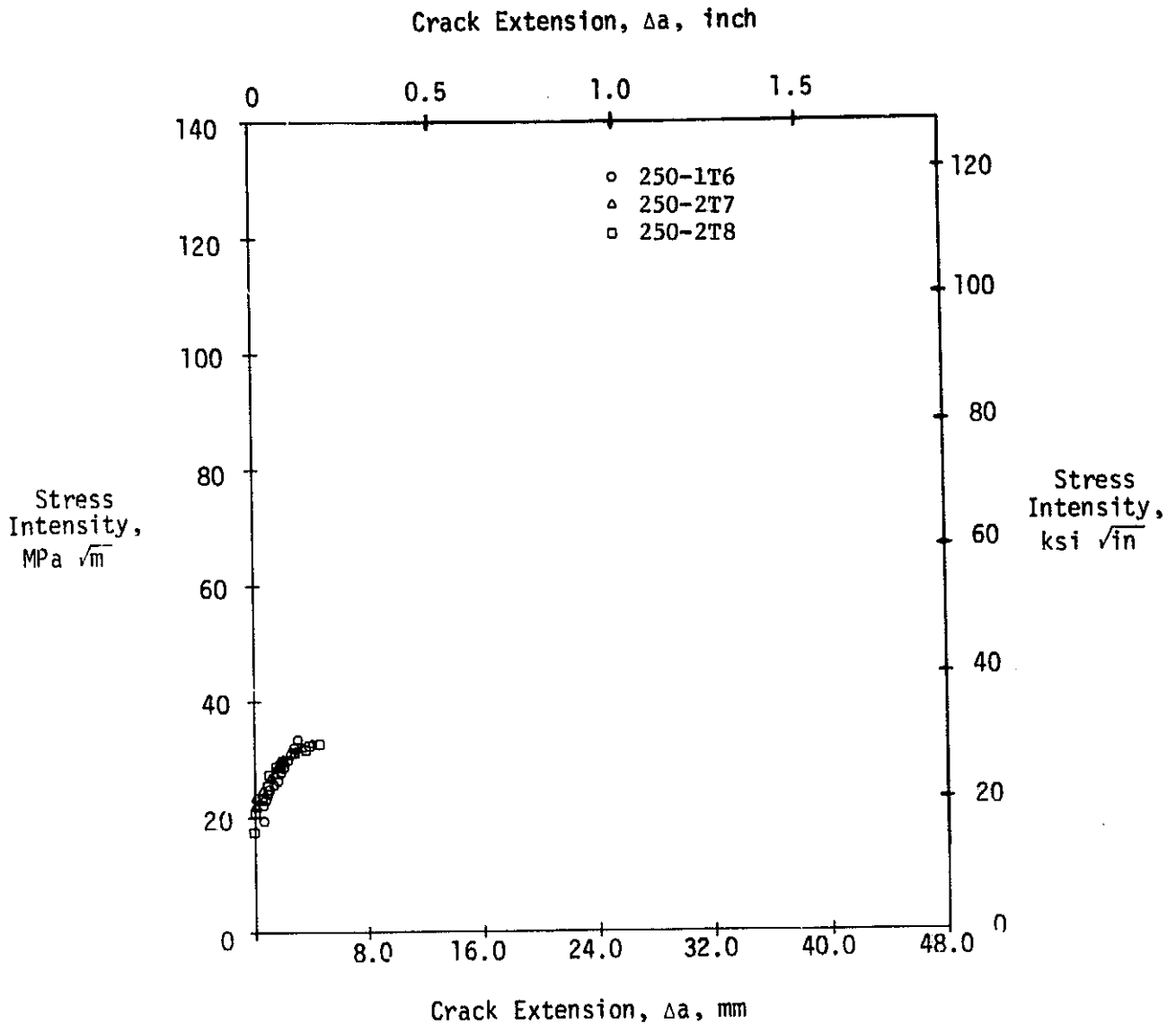
Temperature: 298°K (70°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 6.35 mm (.250 inch)

Orientation: Transverse

Temperature: 298°K (70°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

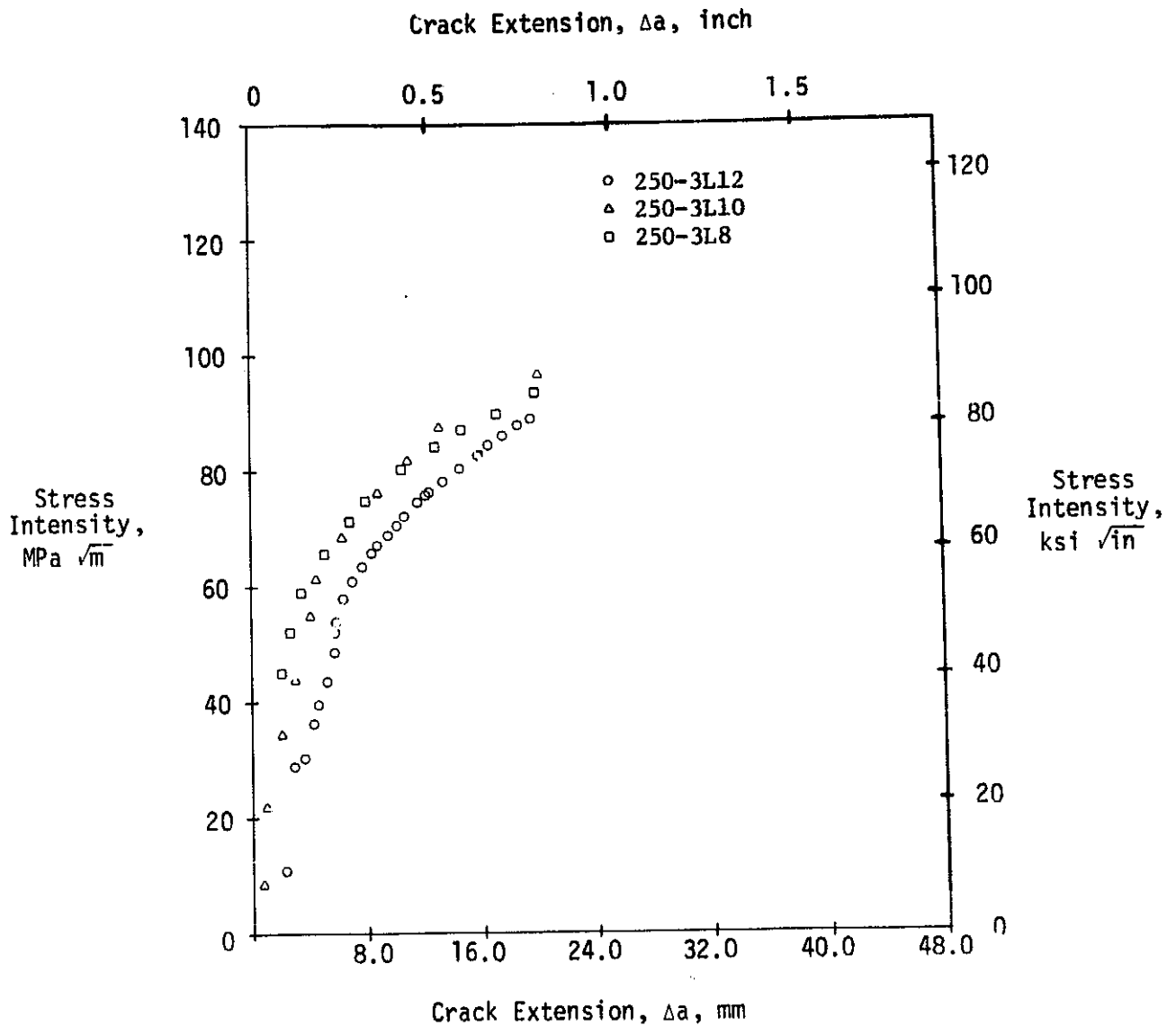
C-80

FIGURE C5-4

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 6.35 mm (.250 inch)

Orientation: Longitudinal

Temperature: 450°K (350°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

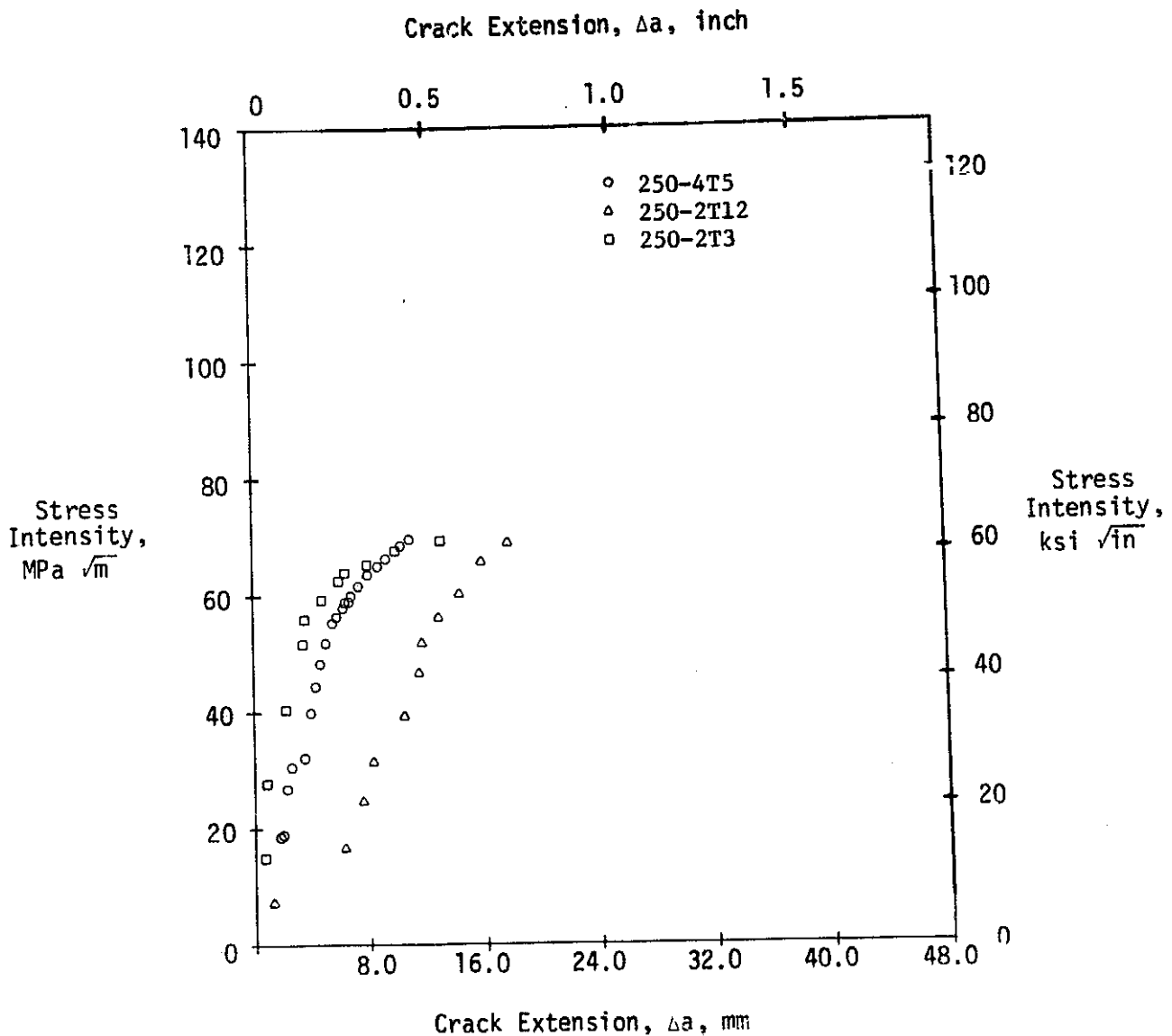
C-81

FIGURE C5-5

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 6.35 mm (.250 inch)

Orientation: Transverse

Temperature: 450°K (350°F)

CRACK GROWTH RESISTANCE CURVE FOR 2024-T861

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FIGURE C5-6

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974

SECTION C6. FRACTURE TOUGHNESS TEST DATA
FOR 6.35 mm (.250 INCH) THICK 2124-T851

TABLE C6-1.
Fracture Toughness Test Data for 2124-T851 Specimens
(6.35 mm (.250 inch) thick)

Specimen Number	Temperature (K)	Orientation	Specimen Dimensions				Precrack Length		Precrack Load		Failure Load		Full Section Failure Stress		Critical Stress Intensity K_{IC}		Data Table No.	Figure No.
			Thickness mm	in	Width cm	in	mm	in	kN	Kip	kN	Kip	MPa	Ksi	MPa√in	Ksi√in		
1L1-253-2	144	L	6.42	.2526	29.733	11.706	88.37	3.48	164.5	37.0	332.5	74.7	174.3	25.3	94.6	86.1	C6-2	C6-1
2L1-256-2	144	L	6.41	.2524	29.596	11.652	44.55	1.75	222.4	50.0	492.6	110.7	259.7	37.7	86.0	78.3	C6-3	C6-1
5L5-259-1	144	L	6.48	.2550	29.708	11.695	28.63	1.13	306.9	69.0	618.3	139.0	321.4	46.6	87.3	79.4	C6-4	C6-1
														AVG:	89.3	81.3		
2L2-253-2	294	L	6.42	.2529	29.685	11.687	89.03	3.50	151.2	34.0	385.2	86.6	202.0	29.3	100.0	91.0	C6-5	C6-3
4L3-259-1	294	L	6.07	.2390	29.708	11.696	50.39	1.98	222.4	50.0	451.5	103.7	255.9	37.1	84.6	77.0	C6-6	C6-3
1L2-256-3	294	L	6.40	.2520	29.548	11.633	28.09	1.11	177.9	40.0	532.7	119.7	281.7	40.8	77.4	70.4	C6-7	C6-3
														AVG:	87.2	79.5		
2L2-253-1	450	L	6.44	.2534	29.695	11.691	124.87	4.92	173.5	39.0	367.0	82.5	192.0	27.8	NSY		C6-8	C6-5
5L5-259-3	450	L	6.31	.2483	29.670	11.681	99.95	3.94	204.6	46.0	434.8	97.7	232.4	33.7	NSY		C6-9	C6-5
2L3-256-1	450	L	6.40	.2518	29.705	11.695	88.72	3.49	129.0	29.0	444.8	100.0	244.2	34.0	*		*	*
2T7-253-4	144	T	6.37	.2507	29.731	11.705	89.08	3.51	106.8	35.0	257.6	57.9	136.1	19.7	76.4	59.5	C6-10	C6-2
3T8-259-2	144	T	6.31	.2484	29.688	11.688	40.72	1.60	169.0	38.0	351.4	79.0	187.6	27.2	58.3	53.0	C6-11	C6-2
5T2-256-3	144	T	6.41	.2524	29.604	11.655	24.21	.95	209.1	47.0	434.8	97.7	229.1	33.2	56.7	51.6	C6-12	C6-2
														AVG:	63.1	58.0		
1T1-253-2	294	T	6.34	.2498	29.710	11.697	89.59	3.53	111.2	25.0	262.0	58.9	139.0	20.2	54.7	49.8	C6-13	C6-4
1T8-256-2	294	T	6.43	.2530	29.759	11.716	28.68	1.13	177.9	40.0	412.4	92.7	215.7	31.3	52.9	48.2	C6-14	C6-4
3T9-259-3	294	T	6.36	.2503	29.670	11.681	12.27	.48	311.4	70.0	645.0	145.0	342.0	49.6	58.9	53.6	C6-15	C6-4
														AVG:	55.5	50.5		
2T7-253-2	450	T	6.38	.2513	29.708	11.696	99.19	3.91	195.7	44.0	421.5	94.7	222.3	32.2	NSY		C6-16	C6-6
2T3-256-2	450	T	6.41	.2525	29.588	11.649	87.48	3.44	129.0	29.0	424.8	95.5	223.9	32.5	NSY		C6-17	C6-5
1T4-259-2	450	T	6.36	.2503	29.632	11.666	76.73	3.02	226.9	51.0	462.6	104.0	245.6	35.6	NSY		C6-18	C6-6

* Compliance gage slipped on knife edges.

NSY Net section stress greater than 0.2 percent offset yield strength prior to failure.

SPECIMEN NUMBER: 4L3-259-1
 ALLOY: 2124-T851
 ORIENTATION: LONGITUDINAL
 CONSTRAINT: UNSTIFFENED
 TEST TEMPERATURE: 294.0 K
 SPECIMEN THICKNESS: 6.07 MM (0.239 IN)
 K (MAX) DURING PRECRACKING: 35.33 MPA SQRT(M) (32.15 KSI SQRT(IN))

LOAD		COD		A, HALF CRACK LENGTH		DELTA A		STRESS		INTENSITY		FULL SECTION		STRESS		NET SECTION	
KN	KIPS	E-3 MM	E-3 IN	MM	IN	MM	IN	MPA	SQRT(N)	KSI	SQRT(IN)	MPA	KSI	MPA	KSI	MPA	KSI
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	0.2	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0
2.0	0.4	0.2	0.0	0.2	0.0	0.2	0.0	0.2	0.0	0.2	0.0	0.2	0.0	0.2	0.0	0.2	0.0
3.0	0.7	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
4.0	0.9	0.4	0.0	0.4	0.0	0.4	0.0	0.4	0.0	0.4	0.0	0.4	0.0	0.4	0.0	0.4	0.0
5.0	1.1	0.5	0.0	0.5	0.0	0.5	0.0	0.5	0.0	0.5	0.0	0.5	0.0	0.5	0.0	0.5	0.0
6.0	1.3	0.6	0.0	0.6	0.0	0.6	0.0	0.6	0.0	0.6	0.0	0.6	0.0	0.6	0.0	0.6	0.0
7.0	1.6	0.7	0.0	0.7	0.0	0.7	0.0	0.7	0.0	0.7	0.0	0.7	0.0	0.7	0.0	0.7	0.0
8.0	1.8	0.8	0.0	0.8	0.0	0.8	0.0	0.8	0.0	0.8	0.0	0.8	0.0	0.8	0.0	0.8	0.0
9.0	2.0	0.9	0.0	0.9	0.0	0.9	0.0	0.9	0.0	0.9	0.0	0.9	0.0	0.9	0.0	0.9	0.0
10.0	2.2	1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0
11.0	2.5	1.1	0.0	1.1	0.0	1.1	0.0	1.1	0.0	1.1	0.0	1.1	0.0	1.1	0.0	1.1	0.0
12.0	2.7	1.2	0.0	1.2	0.0	1.2	0.0	1.2	0.0	1.2	0.0	1.2	0.0	1.2	0.0	1.2	0.0
13.0	3.0	1.3	0.0	1.3	0.0	1.3	0.0	1.3	0.0	1.3	0.0	1.3	0.0	1.3	0.0	1.3	0.0
14.0	3.3	1.4	0.0	1.4	0.0	1.4	0.0	1.4	0.0	1.4	0.0	1.4	0.0	1.4	0.0	1.4	0.0
15.0	3.6	1.5	0.0	1.5	0.0	1.5	0.0	1.5	0.0	1.5	0.0	1.5	0.0	1.5	0.0	1.5	0.0
16.0	3.9	1.6	0.0	1.6	0.0	1.6	0.0	1.6	0.0	1.6	0.0	1.6	0.0	1.6	0.0	1.6	0.0
17.0	4.2	1.7	0.0	1.7	0.0	1.7	0.0	1.7	0.0	1.7	0.0	1.7	0.0	1.7	0.0	1.7	0.0
18.0	4.5	1.8	0.0	1.8	0.0	1.8	0.0	1.8	0.0	1.8	0.0	1.8	0.0	1.8	0.0	1.8	0.0
19.0	4.8	1.9	0.0	1.9	0.0	1.9	0.0	1.9	0.0	1.9	0.0	1.9	0.0	1.9	0.0	1.9	0.0
20.0	5.1	2.0	0.0	2.0	0.0	2.0	0.0	2.0	0.0	2.0	0.0	2.0	0.0	2.0	0.0	2.0	0.0
21.0	5.4	2.1	0.0	2.1	0.0	2.1	0.0	2.1	0.0	2.1	0.0	2.1	0.0	2.1	0.0	2.1	0.0
22.0	5.7	2.2	0.0	2.2	0.0	2.2	0.0	2.2	0.0	2.2	0.0	2.2	0.0	2.2	0.0	2.2	0.0
23.0	6.0	2.3	0.0	2.3	0.0	2.3	0.0	2.3	0.0	2.3	0.0	2.3	0.0	2.3	0.0	2.3	0.0
24.0	6.3	2.4	0.0	2.4	0.0	2.4	0.0	2.4	0.0	2.4	0.0	2.4	0.0	2.4	0.0	2.4	0.0
25.0	6.6	2.5	0.0	2.5	0.0	2.5	0.0	2.5	0.0	2.5	0.0	2.5	0.0	2.5	0.0	2.5	0.0

SPECIMEN NUMBER:	1L2-256-3
ALLOY:	2124-T851
ORIENTATION:	LONGITUDINAL
CONSTRAINT:	UNSTRESSERD
TEST TEMPERATURE:	294.3 K
SPECIMEN THICKNESS:	6.252 IN
CURING PROCESS:	19.87 MPA SQRT(M) (19.89 KSI SQRT(IN))

[illegible]

TABLE C6-10

SPECIMEN NUMBER:	2T7-253-4
ALLOY:	2124-T851
ORIENTATION:	TRANSVERSE
CONSTRAINT:	UNSTIFFENED
TEST TEMPERATURE:	144.0 K
SPECIMEN THICKNESS:	6.37 MM (.251 IN)
K (MAX) DURING PRECRACKING:	22.34 MPA SQRT (M) (21.33 KSI SQRT (IN))

[illegible]

TABLE C6-11

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SPECIMEN NUMBER: 3T4-259-2
ALLOY: 2124-T8S1
ORIENTATION: TRANSVERSE
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 144.3 K
SPECIMEN THICKNESS: 6.31 MM ( 0.248 IN)
X(MAX) SURF. PRECRACKING: 23.09 MPa SQRT(M) ( 21.01 KSI SQRT(IN))

```

[illegible]

TABLE C6-12

SPECIMEN NUMBER:	5T2-256-3
ALLOY:	2124-T851
ORIENTATION:	TRANSVERSE
CONSTRAINT:	UNSTIFFENED
TEST TEMPERATURE:	144.0 K
SPECIMEN THICKNESS:	6.41 MM (0.252 IN)
K (MAX) CUPING PRECRACKING:	21.57 MPA $\sqrt{QRT(M)}$ (19.63 KSI $\sqrt{QRT(IN)}$)

[illegible]

TABLE C6-13

SPECIMEN NUMBER:	1T1-293-2
ALLOY:	2124-T851
ORIENTATION:	TRANSVERSE
CONSTRAINT:	UNSTIFFENED
TEST TEMPERATURE:	294.1 K
SPECIMEN THICKNESS:	6.34 MM (0.251 IN)
K (MAX) DURING PRECRACKING:	23.46 MPA SQRT(M) (21.35 KSI SQRT(IN))

[illegible]

TABLE C6-16

SPECIMEN NUMBER: 2T7-253-2
 ALLOY: 2124-T851
 ORIENTATION: TRANSVERSE
 CONSTRAINT: UNSTIFFENED
 TEST TEMPERATURE: 450.0 K
 SPECIMEN THICKNESS: 6.38 MM (.251 IN)
 K (MAX) DURING PRECRACKING: 43.79 MPA SQRT (IN) (39.85 KSI SQRT (IN))

LOAD		COR		A HALF		DELTA A		STRESS		INTENSITY		STRESS	
KN	KIPS	E-3	44	E-3	IN	CRACK	LENGTH	MM	IN	MPA	SQRT(M)	KSI	SQRT(IN)
20.0	4.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
25.0	5.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
30.0	6.7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
35.0	7.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
40.0	8.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
45.0	10.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
50.0	11.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
55.0	12.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
60.0	13.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
65.0	14.4	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
70.0	15.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
75.0	16.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
80.0	17.7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
85.0	18.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
90.0	19.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
95.0	21.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
100.0	22.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
105.0	23.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
110.0	24.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
115.0	25.4	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
120.0	26.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
125.0	27.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
130.0	28.7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
135.0	29.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
140.0	30.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
145.0	32.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
150.0	33.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
155.0	34.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
160.0	35.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
165.0	36.4	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
170.0	37.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
175.0	38.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
180.0	39.7	1.0	1.0	1.0	1.0	1.0	1						

TABLE C6-17

SPECIMEN NUMBER:	2T3-256-2
ALLOY:	2124-T851
ORIENTATION:	TRANSVERSE
CONSTRAINT:	UNSTIFFENED
TEST TEMPERATURE:	450.0 K
SPECIMEN THICKNESS:	6.41 MM (.25 IN)
LOADING RATE:	25.65 MPa SQRT(M) (24.25 KSI SQRT(IN))

LOAD		CDD		A HALF		DELTA A		STRESS		INTENSITY		FULL SECTION		STRESS	
KN	KIPS	E-3	44	E-3	IN	CRACK	LENGTH	MM	IN	MPA	SQRT (H)	KSI	SQRT (IN)	HPS	NET SECTION
						M4	IN								KSI
0	0					43	74	0	0	0	0	0	0	0	0
1	1					43	77	0	0	0	0	0	0	0	0
2	2					43	77	0	0	0	0	0	0	0	0
3	3					43	77	0	0	0	0	0	0	0	0
4	4					43	77	0	0	0	0	0	0	0	0
5	5					43	77	0	0	0	0	0	0	0	0
6	6					43	77	0	0	0	0	0	0	0	0
7	7					43	77	0	0	0	0	0	0	0	0
8	8					43	77	0	0	0	0	0	0	0	0
9	9					43	77	0	0	0	0	0	0	0	0
10	10					43	77	0	0	0	0	0	0	0	0
11	11					43	77	0	0	0	0	0	0	0	0
12	12					43	77	0	0	0	0	0	0	0	0
13	13					43	77	0	0	0	0	0	0	0	0
14	14					43	77	0	0	0	0	0	0	0	0
15	15					43	77	0	0	0	0	0	0	0	0
16	16					43	77	0	0	0	0	0	0	0	0
17	17					43	77	0	0	0	0	0	0	0	0
18	18					43	77	0	0	0	0	0	0	0	0
19	19					43	77	0	0	0	0	0	0	0	0
20	20					43	77	0	0	0	0	0	0	0	0
21	21					43	77	0	0	0	0	0	0	0	0
22	22					43	77	0	0	0	0	0	0	0	0
23	23					43	77	0	0	0	0	0	0	0	0
24	24					43	77	0	0	0	0	0	0	0	0
25	25					43	77	0	0	0	0	0	0	0	0
26	26					43	77	0	0	0	0	0	0	0	0
27	27					43	77	0	0	0	0	0	0	0	0
28	28					43	77	0	0	0	0	0	0	0	0
29	29					43	77	0	0	0	0	0	0	0	0
30	30					43	77	0	0	0	0	0	0	0	0
31	31					43	77	0	0	0	0	0	0	0	0
32	32					43	77	0	0	0	0	0	0	0	0
33	33					43	77	0	0	0	0	0	0	0	0
34	34					43	77	0	0	0	0	0	0	0	0
35	35					43	77	0	0	0	0	0	0	0	0
36	36					43	77	0	0	0	0	0	0	0	0

TABLE C6-18

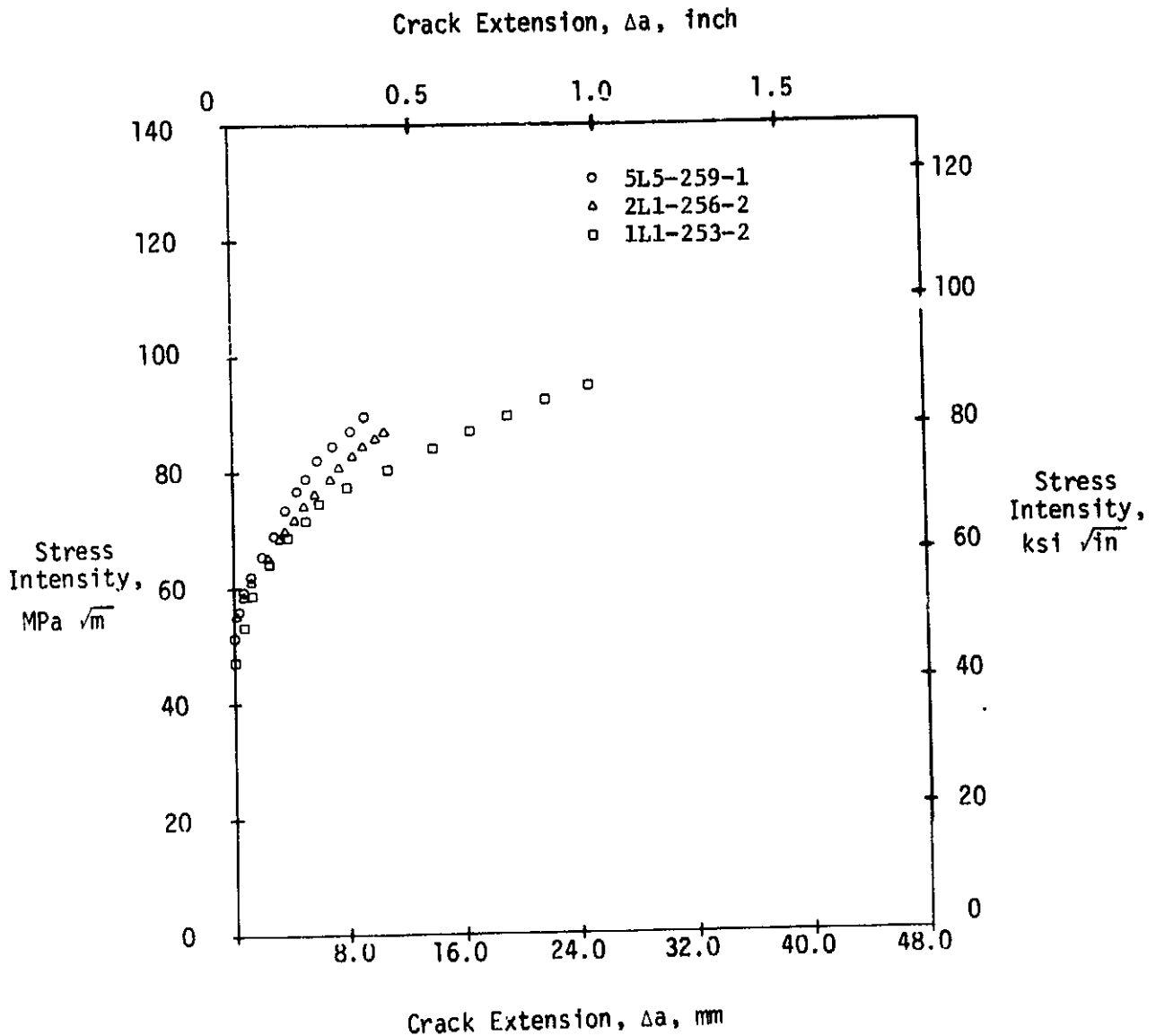
SPECIMEN NUMBER: 1T4-259-2
 ALLOY: 2124-T851
 ORIENTATION: TRANSVERSE
 CONSTRAINT: UNSTIFFENED
 TEST TEMPERATURE: 454.8 K
 SPECIMEN THICKNESS: 6.36 MM (0.25 IN)
 * (MAX) UPPING PRECRACKING: 43.63 MPA SORT (M) (39.7 KSI SORT (IN))

[illegible]

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 6.35 mm (.250 inch)

Orientation: Longitudinal

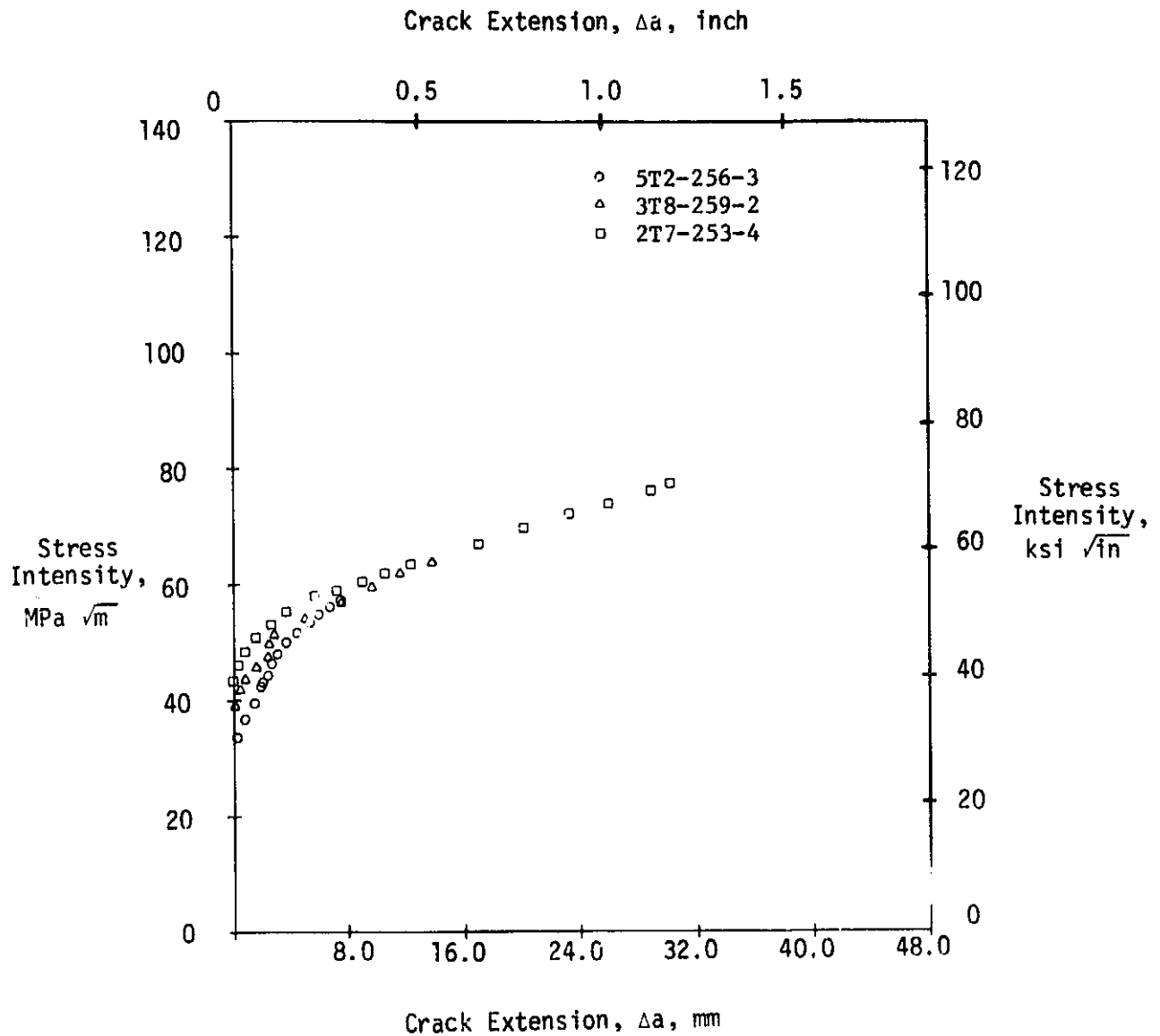
Temperature: 144°K (-200°F)

CRACK GROWTH RESISTANCE CURVE FOR 2124-T851

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 6.35 mm (.250 inch)

Orientation: Transverse

Temperature: 144°K (-200°F)

CRACK GROWTH RESISTANCE CURVE FOR 2124-T851

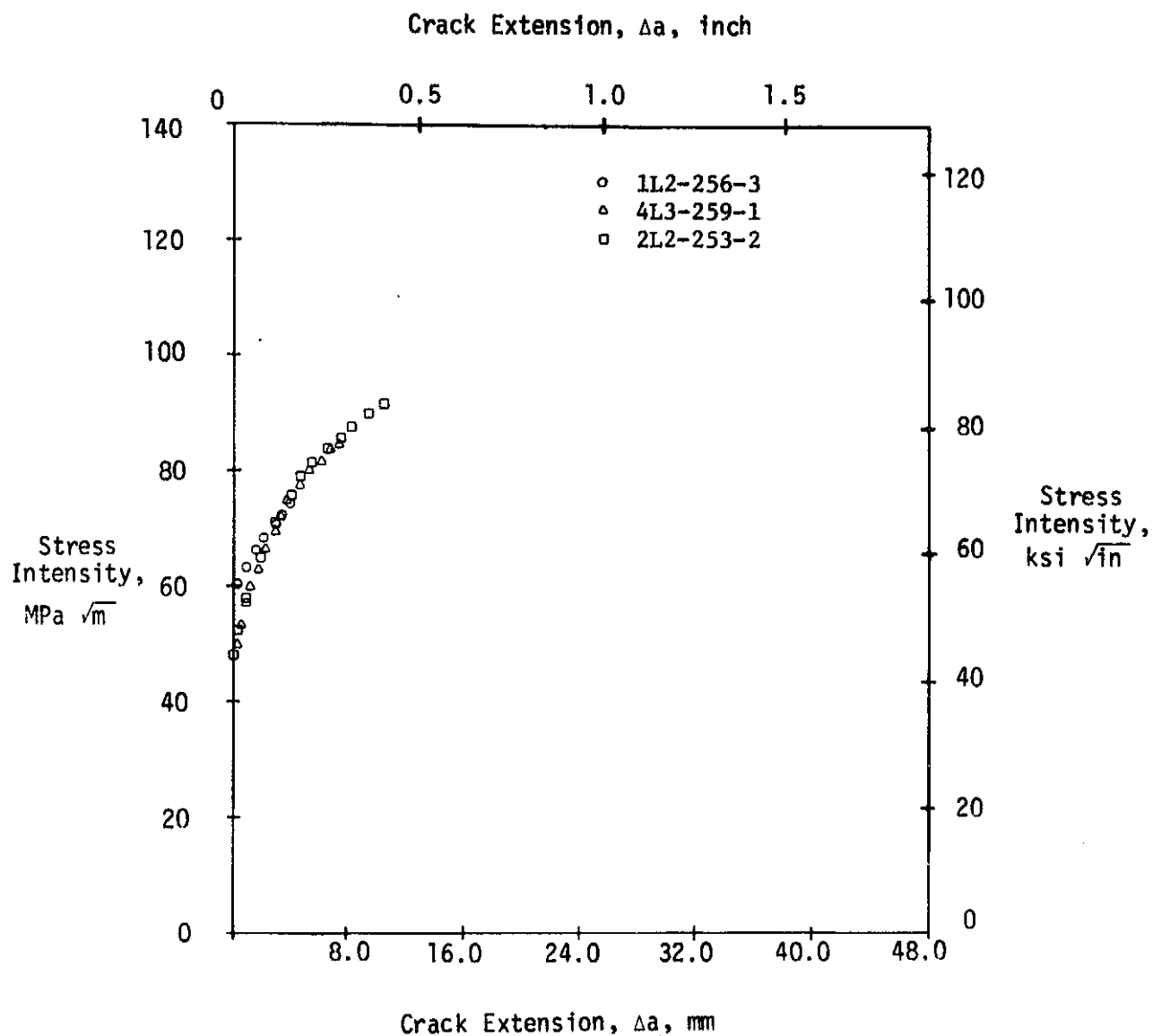
C-95

FIGURE C6-2

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 6.35 mm (.250 inch)

Orientation: Longitudinal

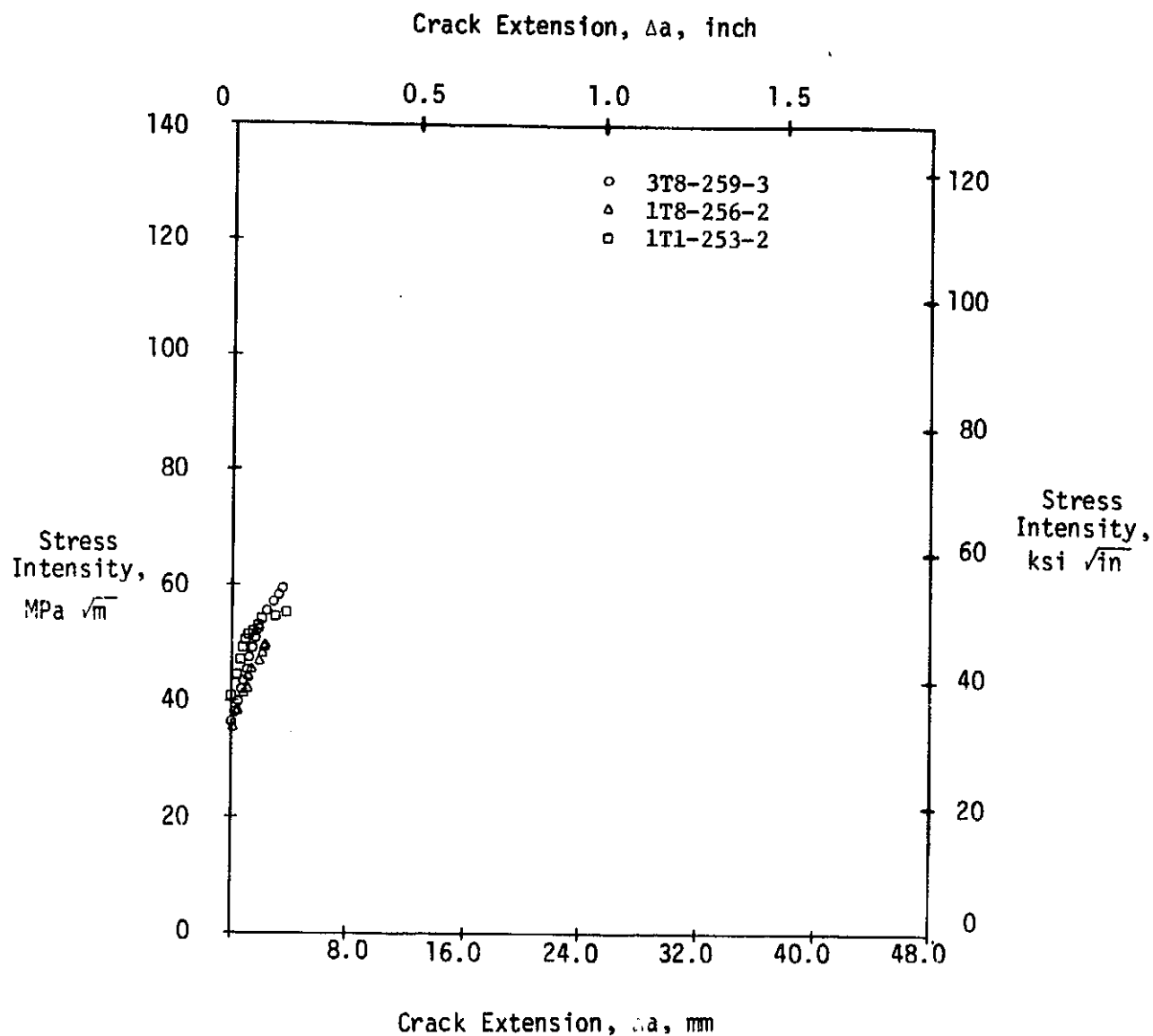
Temperature: 298°K (70°F)

CRACK GROWTH RESISTANCE CURVE FOR 2124-T851

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 6.35 mm (.250 inch)

Orientation: Transverse

Temperature: 298°K (70°F)

CRACK GROWTH RESISTANCE CURVE FOR 2124-T851

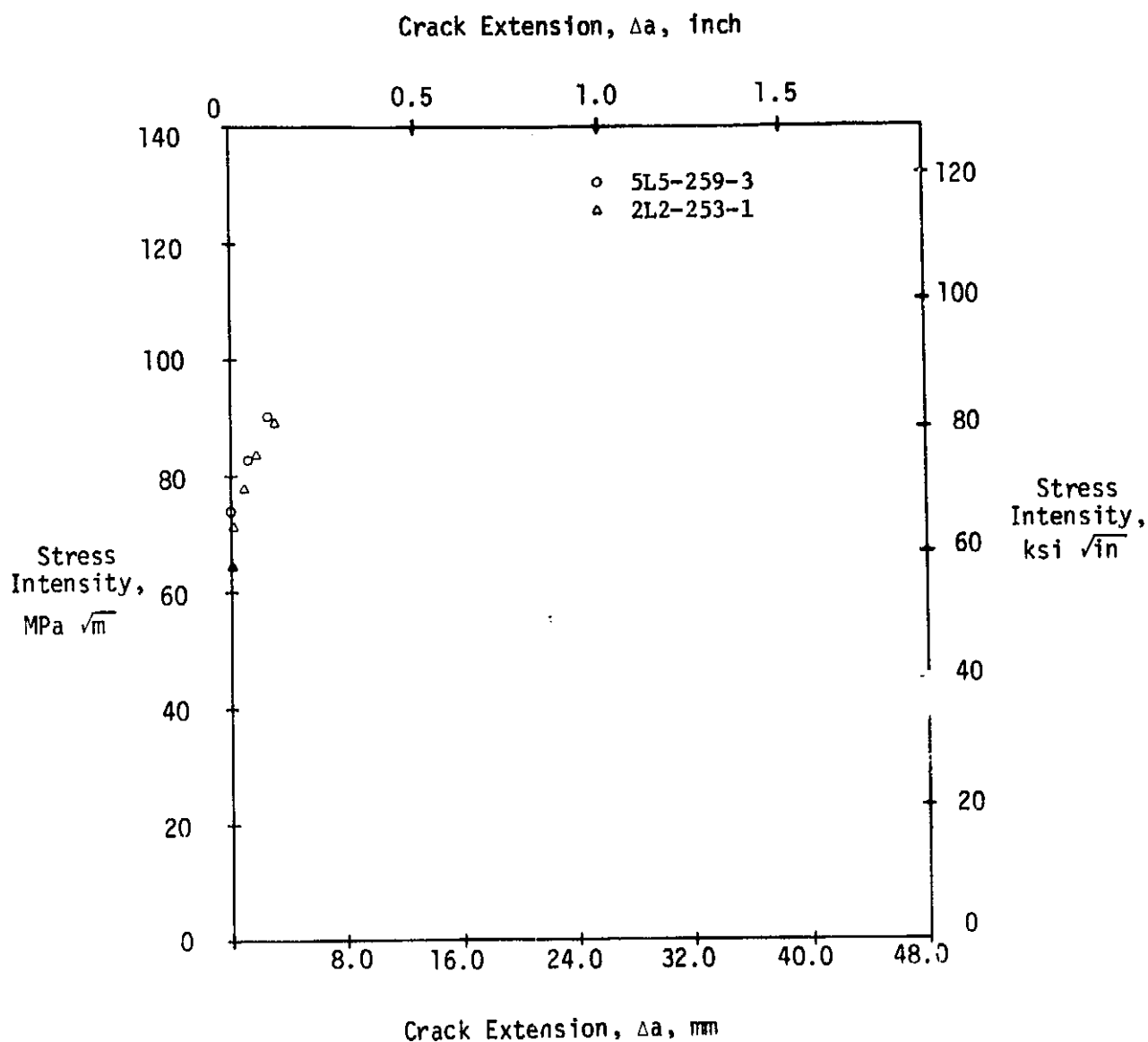
C-97

FIGURE C6-4

FINAL REPORT

MDC E1153
October 1974

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851



Thickness: 6.35 mm (.250 inch)

Orientation: Longitudinal

Temperature: 450°K (350°F)

CRACK GROWTH RESISTANCE CURVE FOR 2124-T851

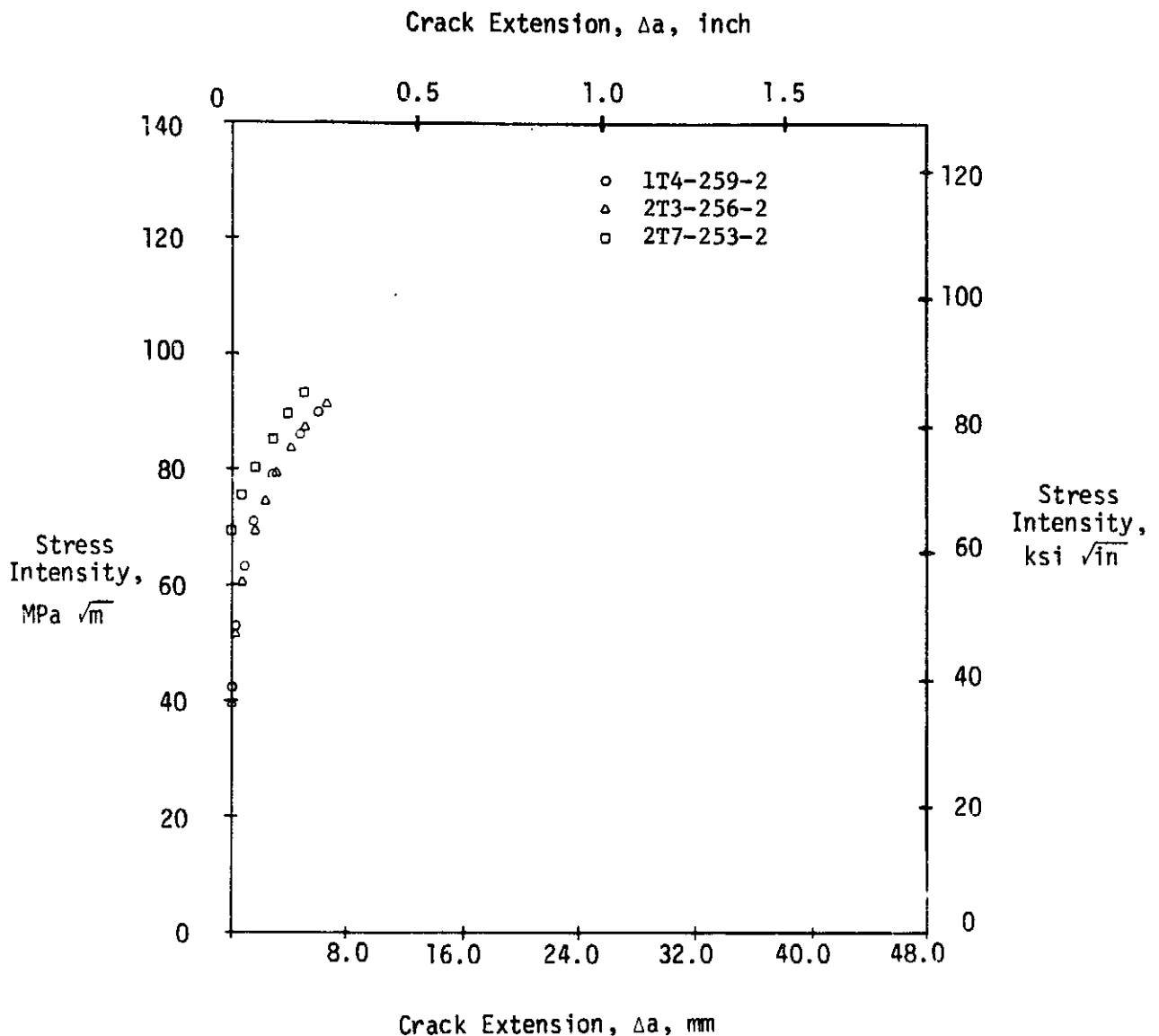
C-98

FIGURE C6-5

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974

SECTION C7. FRACTURE TOUGHNESS TEST DATA
FOR 11.43 mm (.450 INCH) THICK 2124-T851

PRECEDING PAGE BLANK NOT FILMED

C-101

TABLE C7-1.
Fracture Toughness Test Data for 2124-T851 Specimens
(11.43 mm (.450 inch) thick)

Specimen Number	Temperature (K)	Orientation	Thickness mm	Specimen Dimensions			Precrack Length		Precrack Load		Failure Load	Full Section Failure Stress	Critical Stress Intensity, K_{IC} $\sqrt{\text{ksi} \cdot \text{in}}$	Data Table No.	Figure No.		
			in	mm	in	mm	in	mm	kN	kip	kN	MPa	MPa $\sqrt{\text{m}}$				
3L1-453-1	104	L	11.43	4500	29.726	11.703	88.24	3.47	249.1	56.0	633.9	142.5	186.6	27.1	114.6	104.3	C7-3
4L1-456-2	144	L	11.52	4536	29.703	11.694	39.57	1.56	333.6	75.0	780.7	175.5	228.2	33.1	78.3	71.2	C7-3
4L5-459-2	144	L	11.49	4522	29.662	11.678	19.86	.78	333.6	75.0	1003.1	225.5	294.5	42.7	AVG: 96.5	87.8	C7-4
4L12-453-3	294	L	11.39	4486	29.705	11.695	88.62	3.49	249.1	56.0	834.0	187.5	246.4	35.7	**	**	C7-5
5L3-459-2	294	L	11.48	4520	29.675	11.683	31.60	1.24	333.6	75.0	960.8	216.0	282.1	40.9	88.1	60.2	C7-6
4L5-456-1	294	L	11.43	4500	29.721	11.701	15.87	.63	355.9	80.0	1296.7	291.5	381.8	55.4	AVG: 79.1	72.0	C7-7
4L6-456-2	450	L	11.42	4498	29.688	11.688	113.33	4.46	311.4	70.0	725.1	163.0	213.8	31.0	NSY	NSY	C7-8
4L9-453-1	450	L	11.34	4465	29.705	11.695	89.43	3.52	306.9	69.0	722.8	162.5	214.6	31.1	NSY	NSY	C7-9
4L1-459-1	450	L	11.51	4532	29.682	11.686	78.84	3.10	333.6	75.0	866.3	194.7	253.6	36.8	NSY	NSY	C7-10
376-456-1	144	T	11.59	4563	29.693	11.690	89.51	3.52	151.2	34.0	350.3	78.7	101.8	14.8	47.7	43.4	C7-11
579-459-2	144	T	11.37	4477	29.684	11.671	21.03	.83	333.6	75.0	612.7	137.7	181.8	26.4	43.9	38.1	C7-12
311-459-2	144	T	11.41	4493	29.675	11.683	13.03	.51	333.6	75.0	814.0	183.0	240.4	34.9	41.9	38.1	C7-13
												AVG: 44.5	44.5	40.5			C7-14
272-453-2	294	T	11.36	4474	29.642	11.670	87.73	3.45	154.6	37.0	411.0	92.4	122.0	17.7	51.9	47.2	C7-15
571-456-1	294	T	11.22	4416	29.705	11.695	16.00	.63	355.9	80.0	830.7	186.7	349.4	36.2	45.4	41.3	C7-16
317-459-1	294	T	11.64	4583	29.736	11.707	11.15	.44	333.6	75.0	874.1	196.5	252.6	36.6	36.1	33.0	C7-17
												AVG: 44.5	44.5	40.5			C7-18
117-453-3	450	T	11.44	4502	29.677	11.684	92.25	3.63	329.2	74.0	730.6	164.2	215.3	31.2	NSY	NSY	C7-19
115-459-1	450	T	11.47	4516	29.688	11.688	67.01	2.64	333.6	75.0	795.1	178.7	233.5	33.9	NSY	NSY	C7-20
514-456-2	450	T	11.37	4477	29.698	11.692	38.76	1.53	266.9	60.0	1031.9	231.7	305.3	44.3	**	**	C7-21

* Recorder malfunction prior to failure.

** Compliance gage slipped on knife edges.

NSY Net section stress greater than 0.2 percent offset yield strength prior to failure.

FRACTURE MECHANICS DATA FOR

2024-T861 AND 2124-T851

SPECIMEN NUMBER: 5L1-453-1
 ALLLOY: 2124-T851
 ORIENTATION: LONGITUDINAL
 CONSTRAINT: UNSTIFFENED
 TEST TEMPERATURE: 144.0 C K
 SPECIMEN THICKNESS: 11.43 MM (.450 IN)
 K (MAX) DURING PRECRACKING: 28.88 MPA SQRT(M) (26.28 KSI SQRT(IN))

ORIGINAL PAGE IS
OF POOR QUALITY

SPECIMEN NUMBER: 4L1-456-2
ALLOY: 2124-T851
ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 144.1 K
SPECIMEN THICKNESS: 11.32 MM (+.54 IN)
K (MAX) DURING PRECRACKING: 24.58 MPa SQRT (M) (1.275 SI SQRT (IN))

[illegible]

SPECIMEN NUMBER: 4L5-459-2
 ORIENTATION: 2124-T851
 CONSTRAINT: LONGITUDINAL
 TEST TEMPERATURE: UNSTIFFENED
 SPECIMEN THICKNESS: 144.0 K
 K (MAX) DURING PRECRACKING: 17.34 MPA SQRT (M) (11.49 MM (4.52 IN)
 15.78 KSI SQRT (IN))

[illegible]

SPECIMEN NUMBER: 4L12-453-3
 ALL DY: 2124-T851
 ORIENTATION: LONGITUDINAL
 CONSTRAINT: UNSTIFFENED
 TEST TEMPERATURE: 294.0 K
 SPECIMEN THICKNESS: 11.39 MM (1.449 IN)
 X (MAX) DURING PRECRACKING: 29.07 MPA SQRT(M) (26.46 KSI SQRT(IN))

[illegible]

TABLE C7-6

SPECIMEN NUMBER:
ALLOY:
ORIENTATION:
CONSTRAINT:
TEST TEMPERATURE:
SPECIMEN THICKNESS:
K (MAX) DURING PRECRACKING:

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SL3-459-2
2124-T851
LONGITUDINAL
UNSTIFFENED
294-C-K
11.48 MM (.452 IN)
21.97 MPA SQRT(M) ( 19.99 KSI SQRT(IN))

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[illegible]

TABLE C7-8

4L5-456-1
2124-T451
LONGITUDINAL
UNSTIFFEDED
294. J K
11.43 MM (1.450 IN)
16.57 MPA SORT(M) (15.03 KSI SORT(IN))

LCAU		COD		A, HALF CRACK LENGTH		DELTA A		STRESS		INTENSITY		FULL SECTION		STRESS		NET SECTION	
KN	KIPS	F-3 MM	C-3 IN	MM	IN	MM	IN	MPA	SQRT(M)	KSI	SQRT (IN)	MPA	KSI	MPA	KSI	MPA	KSI
6.0	0.6	3.0	3.00	7.94	.312	0.00	0.000	5.00	5.00	5.00	5.00	5.00	5.00	0.00	0.00	0.00	0.00
150.6	33.6	2.99	1.83	8.18	.322	0.24	0.010	7.12	7.12	6.48	6.48	44.34	6.43	46.92	6.88	6.88	6.88
298.8	67.0	2.99	1.77	8.18	.322	0.82	0.032	14.62	14.62	13.30	13.30	87.95	12.43	93.46	13.55	13.55	13.55
449.2	101.1	2.99	1.84	8.18	.322	1.22	0.048	22.49	22.49	20.25	20.25	132.25	19.19	140.94	20.44	20.44	20.44
713.8	160.5	2.99	1.13	9.99	.390	1.08	0.045	35.44	35.44	32.25	32.25	210.15	30.48	223.73	32.44	32.44	32.44
822.9	185.0	2.99	1.63	9.99	.390	1.15	0.045	41.03	41.03	37.34	37.34	242.28	35.13	258.06	37.42	37.42	37.42
907.7	204.4	2.99	1.83	9.99	.390	1.22	0.048	45.62	45.62	41.34	41.34	267.25	38.76	284.79	41.30	41.30	41.30
970.6	218.4	2.99	1.22	9.99	.390	1.40	0.055	49.07	49.07	44.66	44.66	285.77	41.44	304.94	44.22	44.22	44.22
1021.4	230.9	2.99	1.15	9.99	.390	1.57	0.062	52.09	52.09	47.40	47.40	300.71	43.61	321.25	46.59	46.59	46.59
1047.8	235.3	2.99	1.24	9.99	.390	1.91	0.075	54.88	54.88	49.49	49.49	308.69	44.76	330.37	47.91	47.91	47.91
1076.6	242.2	2.99	1.11	10.00	.403	2.00	0.081	57.72	57.72	51.87	51.87	316.96	45.96	340.41	49.36	49.36	49.36
1002.9	224.7	2.99	1.11	10.00	.403	2.76	0.109	59.72	59.72	54.35	54.35	324.70	47.09	349.89	50.74	50.74	50.74
1029.1	230.3	2.99	1.11	11.16	.433	3.22	0.127	62.44	62.44	56.83	56.83	332.43	48.21	359.61	52.12	52.12	52.12
1033.6	233.0	2.99	1.11	11.16	.433	3.79	0.149	64.29	64.29	58.31	58.31	339.72	48.40	362.33	53.54	53.54	53.54
1035.4	235.5	2.99	1.11	12.65	.498	4.71	0.186	66.93	66.93	60.91	60.91	344.32	48.47	365.37	55.99	55.99	55.99
1032.1	234.6	2.99	1.11	13.87	.546	5.93	0.234	69.94	69.94	63.65	63.65	353.47	48.34	367.63	58.31	58.31	58.31
1032.7	235.4	2.99	1.11	16.70	.658	8.77	0.345	76.98	76.98	70.05	70.05	363.35	48.36	375.50	60.48	60.48	60.48
1035.9	236.5	2.99	1.11	19.34	.762	11.40	0.449	83.28	83.28	75.79	75.79	374.35	48.49	384.58	62.74	62.74	62.74
1054.1	239.9	2.99	1.11	22.66	.893	12.33	0.485	86.70	86.70	79.96	79.96	389.79	49.28	393.32	65.78	65.78	65.78
1072.1	240.3	2.99	1.11	25.51	.999	13.00	0.515	89.83	89.83	81.75	81.75	395.25	50.07	402.16	67.89	67.89	67.89
1095.5	246.3	2.99	1.11	28.22	1.116	14.61	0.568	94.58	94.58	86.07	86.07	351.98	51.04	414.29	69.08	69.08	69.08
1018.9	227.3	2.99	1.11	30.99	1.224	15.47	0.609	96.78	96.78	89.89	89.89	358.73	52.02	425.74	71.75	71.75	71.75
1038.9	234.3	2.99	1.11	33.74	1.330	16.59	0.653	99.00	99.00	93.75	93.75	364.74	52.89	436.33	74.50	74.50	74.50
1052.3	241.1	2.99	1.11	36.49	1.437	17.52	0.690	101.22	101.22	97.61	97.61	368.68	53.47	444.91	77.25	77.25	77.25
1068.0	245.5	2.99	1.11	39.24	1.544	18.35	0.723	103.44	103.44	101.47	101.47	373.33	54.14	453.63	80.00	80.00	80.00
1079.9	247.5	2.99	1.11	42.00	1.650	19.19	0.759	105.66	105.66	105.66	105.66	376.56	54.61	460.94	82.75	82.75	82.75
1090.0	249.0	2.99	1.11	44.75	1.757	20.00	0.792	107.88	107.88	109.88	109.88	379.78	55.07	468.18	85.50	85.50	85.50
1091.4	249.3	2.99	1.11	47.50	1.864	20.83	0.832	110.10	110.10	114.10	114.10	380.20	55.14	472.63	88.25	88.25	88.25
1098.0	249.8	2.99	1.11	50.25	1.971	21.66	0.874	112.32	112.32	118.32	118.32	382.16	55.42	476.63	91.00	91.00	91.00

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449-453-2
2124-T951
LONGITUDINAL
UNSTIFFENED
450.0 K
11.42 MM (.450 IN)
42.63 MPA SQRT(M) ( 38.80 KSI SQRT(IN))

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[illegible]

TABLE C7-9

SPECIMEN NUMBER: 416-456-1
ALLOY: 2124-T851
ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 453.0 K
SPECIMEN THICKNESS: 11.34 MM (.447 IN)
K (MAX) DURING PRECRACKING: 36.19 MPA SQRT(M) (32.94 KSI SQRT(IN))

KN	LOAD KIPS	COD		A, HALF CRACK LENGTH MM	IN	DELTA A MM	IN	MPA STRESS SQRT(M)	KSI INTENSITY SQRT(IN)	STRESS		NET SECTION	
		E-3 MM	E-3 IN							FULL SECTION MPA	KSI	MPA	KSI
0.0	0.0	0.00	0.00	44.72	1.760	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00
2.0	0.4	0.00	0.00	44.76	1.762	0.05	0.002	57.81	5.00	14.50	3.28	26.80	30.19
4.0	0.9	0.00	0.00	44.81	1.768	0.70	0.027	65.38	5.69	16.30	3.64	28.40	32.40
6.0	1.4	0.00	0.00	45.41	1.832	1.81	0.071	72.36	6.39	17.70	3.96	30.58	34.76
8.0	1.8	0.00	0.00	46.53	1.856	2.43	0.096	76.73	6.79	18.60	4.19	32.73	37.20
10.0	2.2	0.00	0.00	47.15	1.921	4.09	0.161	82.77	7.33	19.70	4.44	34.67	39.57
12.0	2.7	0.00	0.00	48.83	1.967	5.25	0.207	86.72	7.80	20.30	4.53	36.57	41.41
14.0	3.1	0.00	0.00	49.96	2.048	7.31	0.288	91.03	8.20	20.70	4.61	38.02	43.41
16.0	3.6	0.00	0.00	52.33	2.110	8.89	0.353	*	*	21.00	4.68	39.46	45.00
18.0	4.0	0.00	0.00	53.81	2.183	10.74	0.423	*	*	21.00	4.76	40.90	46.72
20.0	4.5	0.00	0.00	55.13	2.287	13.38	0.527	*	*	21.00	4.88	42.34	48.41
22.0	4.9	0.00	0.00	56.13	2.443	17.33	0.692	*	*	21.00	5.00	43.76	50.00
24.0	5.4	0.00	0.00	57.15	2.443	17.33	0.692	*	*	21.00	5.00	45.19	51.72

TABLE C7-10

SPECIMEN NUMBER: 411-459-1
ALLOY: 2124-T851
ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 453.0 K
SPECIMEN THICKNESS: 11.51 MM (.453 IN)
K (MAX) DURING PRECRACKING: 35.94 MPA SQRT(M) (32.70 KSI SQRT(IN))

KN	LOAD KIPS	COD		A, HALF CRACK LENGTH MM	IN	DELTA A MM	IN	MPA STRESS SQRT(M)	KSI INTENSITY SQRT(IN)	STRESS		NET SECTION	
		E-3 MM	E-3 IN							FULL SECTION MPA	KSI	MPA	KSI
0.0	0.0	0.00	0.00	39.42	1.552	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00
2.0	0.4	0.00	0.00	40.03	1.576	0.61	0.023	59.62	5.40	16.00	3.57	21.90	24.78
4.0	0.9	0.00	0.00	41.26	1.629	1.84	0.073	68.93	6.27	19.20	4.33	24.90	28.11
6.0	1.4	0.00	0.00	41.95	1.652	2.93	0.100	76.47	6.90	20.00	4.44	27.90	31.11
8.0	1.8	0.00	0.00	43.32	1.713	4.09	0.161	83.82	7.60	21.40	4.72	30.30	34.43
10.0	2.2	0.00	0.00	44.97	1.770	5.25	0.207	90.12	8.20	22.60	5.09	32.40	36.70
12.0	2.7	0.00	0.00	46.87	1.845	7.31	0.288	*	*	23.30	5.19	34.20	39.00
14.0	3.1	0.00	0.00	48.73	1.918	9.31	0.366	*	*	24.10	5.28	35.90	40.67
16.0	3.6	0.00	0.00	50.33	1.984	10.97	0.432	*	*	24.40	5.35	37.10	42.00
18.0	4.0	0.00	0.00	52.00	2.059	12.88	0.507	*	*	24.80	5.45	38.30	43.41
20.0	4.5	0.00	0.00	54.24	2.136	14.82	0.584	*	*	25.10	5.55	39.50	44.76
22.0	4.9	0.00	0.00	56.31	2.225	17.09	0.673	*	*	25.40	5.65	40.70	46.00
24.0	5.4	0.00	0.00	58.94	2.316	19.42	0.764	*	*	25.80	5.75	41.90	47.20
26.0	5.9	0.00	0.00	61.33	2.434	21.81	0.882	*	*	26.10	5.85	43.10	48.41
28.0	6.3	0.00	0.00	64.23	2.539	24.01	0.977	*	*	26.40	5.95	44.30	49.60
30.0	6.8	0.00	0.00	66.94	2.635	27.92	1.083	*	*	26.70	6.05	45.50	50.80
32.0	7.2	0.00	0.00	69.41	2.732	29.97	1.180	*	*	26.90	6.15	46.70	52.00
34.0	7.7	0.00	0.00	71.77	2.826	33.39	1.274	*	*	27.10	6.25	47.90	53.19
36.0	8.1	0.00	0.00	73.20	2.882	33.78	1.330	*	*	27.30	6.35	49.10	54.41

TABLE C7-11

SPECIMEN NUMBER:
ALLOY:
ORIENTATION:
CONSTRAINT:
TEST TEMPERATURE:
SPECIMEN THICKNESS:
K (MAX) DURING PRECRACKING:

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3T6-456-1
2124-T851
TRANSVERSE
UNSTIFFENED
144.0 K
11.59 MM (.456 IN)
17.47 MPA SQRT(M) ( 15.95 KSI SQRT(IN))

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[illegible]

TABLE C7-12

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SPECIMEN NUMBER:
ORIENTATION: ALL OY:
CONSTRAINT:
TEST TEMPERATURE:
SPECIMEN THICKNESS:
X (MAX) DURING PRECRACKING:

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579-453-2
5124-1851
TRANSVERSE
UNSTIFFENED
144.6 K
11.37 MM (.448 IN)
18.04 MPA SORT(M) ( 18.42 KSI SORT(IN))

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[illegible]

TABLE C7-13

SPECIMEN NUMBER: 3T1-459-2
ALLOY: 2124-T851
ORIENTATION: TRANSVERSE
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 146.0 K
SPECIMEN THICKNESS: 11.41 MM (.449 IN)
K (MAX) DURING PRECRACKING: 14.11 MPA SQRT(M) (12.84 KSI SQRT(IN))

LOAD		COD		A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		FULL SECTION		STRESS NET SECTION	
KN	KIPS	E-3 MM	E-3 IN	MM	IN	MM	IN	MPA	SQRT(M)	KSI	SQRT(IN)	MPA	KSI
0	0	0	0	6.532	.256	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00
0.08	0.01	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
0.16	0.02	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
0.24	0.03	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
0.32	0.04	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
0.40	0.05	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
0.48	0.06	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
0.56	0.07	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
0.64	0.08	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
0.72	0.09	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
0.80	0.10	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
0.88	0.11	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
0.96	0.12	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
1.04	0.13	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
1.12	0.14	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
1.20	0.15	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
1.28	0.16	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
1.36	0.17	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
1.44	0.18	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
1.52	0.19	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
1.60	0.20	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
1.68	0.21	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
1.76	0.22	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
1.84	0.23	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
1.92	0.24	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
2.00	0.25	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
2.08	0.26	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
2.16	0.27	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
2.24	0.28	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
2.32	0.29	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
2.40	0.30	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
2.48	0.31	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
2.56	0.32	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
2.64	0.33	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
2.72	0.34	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
2.80	0.35	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
2.88	0.36	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
2.96	0.37	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
3.04	0.38	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
3.12	0.39	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
3.20	0.40	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
3.28	0.41	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
3.36	0.42	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
3.44	0.43	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
3.52	0.44	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
3.60	0.45	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
3.68	0.46	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
3.76	0.47	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
3.84	0.48	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
3.92	0.49	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
4.00	0.50	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
4.08	0.51	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
4.16	0.52	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
4.24	0.53	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
4.32	0.54	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
4.40	0.55	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
4.48	0.56	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
4.56	0.57	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
4.64	0.58	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
4.72	0.59	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
4.80	0.60	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
4.88	0.61	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
4.96	0.62	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
5.04	0.63	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
5.12	0.64	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
5.20	0.65	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
5.28	0.66	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
5.36	0.67	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
5.44	0.68	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
5.52	0.69	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
5.60	0.70	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
5.68	0.71	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
5.76	0.72	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
5.84	0.73	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
5.92	0.74	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
6.00	0.75	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
6.08	0.76	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
6.16	0.77	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
6.24	0.78	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
6.32	0.79	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
6.40	0.80	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
6.48	0.81	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
6.56	0.82	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
6.64	0.83	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
6.72	0.84	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
6.80	0.85	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
6.88	0.86	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
6.96	0.87	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
7.04	0.88	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
7.12	0.89	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
7.20	0.90	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
7.28	0.91	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
7.36	0.92	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
7.44	0.93	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
7.52	0.94	0	0	6.533	.257	0.01	0.001	0.00	0.00	0.00	0.00	0.00	0.00
7.60	0.95	0	0	6.533	.257	0.							

TABLE C7-15

SPECIMEN NUMBER: 5T1-456-1
 ALLOY: 2124-T851
 ORIENTATION: TRANSVERSE
 CONSTRAINT: UNSTIFFENED
 TEST TEMPERATURE: 294.0 K
 SPECIMEN THICKNESS: 11.22 MM (.442 IN)
 K (MAX) DURING PRECRACKING: 16.96 MPA SQRT(M) (15.44 KSI SQRT(IN))

LOAD		COD		A, HALF CRACK LENGTH		DELTA A		STRESS		INTENSITY		STRESS		NET SECTION	
KN	KIPS	E-3 MM	E-3 IN	MM	IN	MM	IN	MPA	SQRT(M)	KSI	SQRT(IN)	MPA	KSI	MPA	KSI
326.0	73.0	1.00	0.00	8.00	.315	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
326.0	73.0	1.00	0.00	8.00	.315	0.00	0.001	15.58	14.18	97.99	14.21	163.50	15.02	163.50	15.02
772.2	173.6	1.60	0.06	8.10	.319	0.00	0.004	32.97	32.73	225.14	22.65	238.12	26.54	238.12	26.54
772.2	173.6	1.60	0.06	8.20	.323	0.00	0.009	35.34	33.98	231.79	23.61	246.30	27.59	246.30	27.59
784.6	176.4	1.60	0.06	8.30	.327	0.00	0.020	39.16	35.64	235.51	24.15	250.28	28.29	250.28	28.29
804.2	181.9	1.60	0.06	8.40	.331	0.00	0.035	40.69	37.03	242.90	24.22	258.37	28.67	258.37	28.67
811.7	182.3	1.60	0.06	8.50	.335	0.00	0.047	41.51	37.78	243.65	24.33	259.74	28.77	259.74	28.77
818.0	183.3	1.60	0.06	8.60	.339	0.00	0.065	42.87	39.01	245.53	24.61	262.60	28.88	262.60	28.88
824.0	185.3	1.60	0.06	8.70	.343	0.00	0.081	44.07	40.11	247.41	24.88	265.35	28.98	265.35	28.98
828.0	186.1	1.60	0.06	8.80	.347	0.00	0.094	45.04	40.89	248.54	25.04	267.24	29.07	267.24	29.07
826.8	185.9	1.60	0.06	8.90	.351	0.00	0.106	45.61	41.51	248.19	25.09	267.43	29.08	267.43	29.08

TABLE C7-16

SPECIMEN NUMBER: 3T7-459-1
 ALLOY: 2124-T851
 ORIENTATION: TRANSVERSE
 CONSTRAINT: UNSTIFFENED
 TEST TEMPERATURE: 294.0 K
 SPECIMEN THICKNESS: 11.64 MM (.458 IN)
 K (MAX) DURING PRECRACKING: 12.77 MPA SQRT(M) (11.62 KSI SQRT(IN))

LOAD		COD		A, HALF CRACK LENGTH		DELTA A		STRESS		INTENSITY		STRESS		NET SECTION	
KN	KIPS	E-3 MM	E-3 IN	MM	IN	MM	IN	MPA	SQRT(M)	KSI	SQRT(IN)	MPA	KSI	MPA	KSI
800.0	180.0	1.00	0.00	5.58	.219	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
800.0	180.0	1.00	0.00	5.58	.219	0.00	0.022	32.16	23.26	231.29	23.54	241.26	26.99	241.26	26.99
837.6	188.0	1.00	0.00	5.60	.220	0.00	0.036	33.81	24.77	242.02	23.10	252.55	27.52	252.55	27.52
847.0	190.0	1.00	0.00	5.65	.223	0.00	0.056	34.84	25.71	244.90	23.51	255.97	27.12	255.97	27.12
847.0	190.0	1.00	0.00	5.65	.223	0.00	0.073	35.51	26.32	244.93	23.62	256.45	27.19	256.45	27.19
847.0	190.0	1.00	0.00	5.65	.223	0.00	0.081	36.48	27.23	243.56	23.32	255.92	27.10	255.92	27.10

TABLE C7-17

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SPECIMEN NUMBER: 117-453-3
ALLOY: 2124-T851
ORIENTATION: TRANSVERSE
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 450-1 K
SPECIMEN THICKNESS: 11.44 MM (.450 IN)
K(MAX) DURING PRECRACKING: 39.29 MPA SQRT(M) ( 35.76 KSI SQRT(IN))

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[illegible]

TABLE C7-18

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SPECIMEN NUMBER: 1T5-459-1
ALLCY: 2124-T861
ORIENTATION: TRANSVERSE
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 45C J K
SPECIMEN THICKNESS: 11.47 MM ( 452 IN)
K(MAX) DURING PRECRACKING: 32.82 MPA SQRT(M) ( 29.87 KSI SQRT(IN))

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[illegible]

TABLE C7-19

SPECIMEN NUMBER:
ALLOY:
ORIENTATION:
CONSTRAINT:
TEST TEMPERATURE:
SPECIMEN THICKNESS:
K (MAX) DURING PRECRACKING:

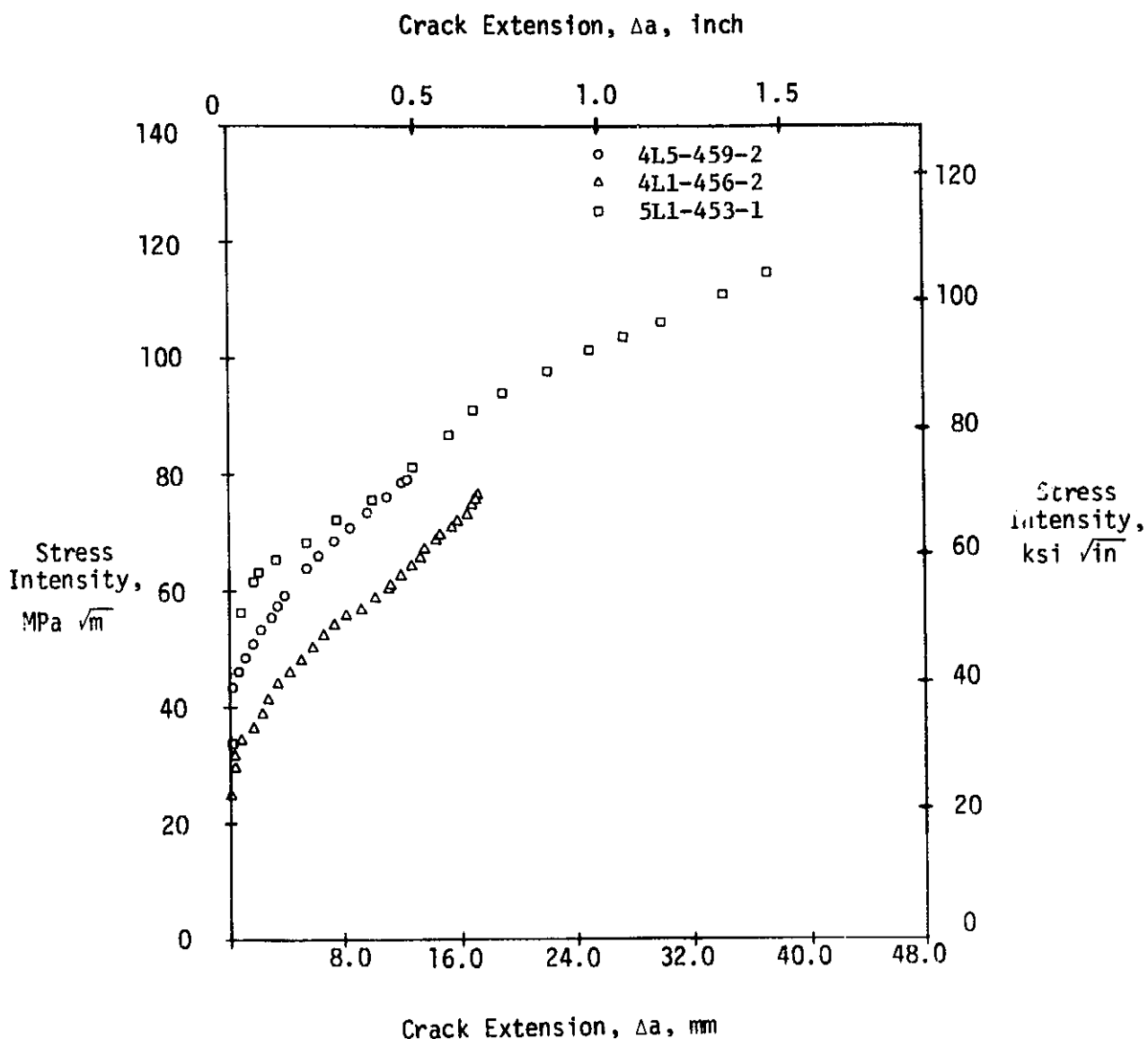
5T4-456-2
2124-T861
TRANSVERSE
UNSTRESSING
450.0 K
11.37 MM (.448 IN)
19.71 MPA SQRT (M) (17.94 KSI SQRT (IN))

LOAD		COD		A, HALF CRACK LENGTH		DELTA A		STRESS INTENSITY		STRESS		FULL SECTION		NET SECTION	
KN	KIPS	E-3 MM	E-3 IN	MM	IN	MM	IN	MPA SQRT (M)	KSI SQRT (IN)	MPA	KSI	MPA	KSI	MPA	KSI
0.0	0.0	0.0	0.0	19.44	.763	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.1	0.0	0.0	0.0	19.54	.771	0.00	0.000	13.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.2	0.0	0.0	0.0	19.64	.775	0.00	0.000	21.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.3	0.0	0.0	0.0	19.74	.778	0.00	0.000	32.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.4	0.0	0.0	0.0	20.44	.805	0.00	0.000	37.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.5	0.0	0.0	0.0	20.33	.800	0.00	0.000	46.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.6	0.0	0.0	0.0	20.33	.801	0.00	0.000	48.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.7	0.0	0.0	0.0	20.33	.800	0.00	0.000	52.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.8	0.0	0.0	0.0	20.33	.809	0.00	0.000	55.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.9	0.0	0.0	0.0	20.33	.809	0.00	0.000	57.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.0	0.0	0.0	0.0	20.91	.823	0.00	0.000	59.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.1	0.0	0.0	0.0	21.06	.829	0.00	0.000	60.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 11.47 mm (.450 inch)

Orientation: Longitudinal

Temperature: 144°K (-200°F)

CRACK GROWTH RESISTANCE CURVE FOR 2124-T851

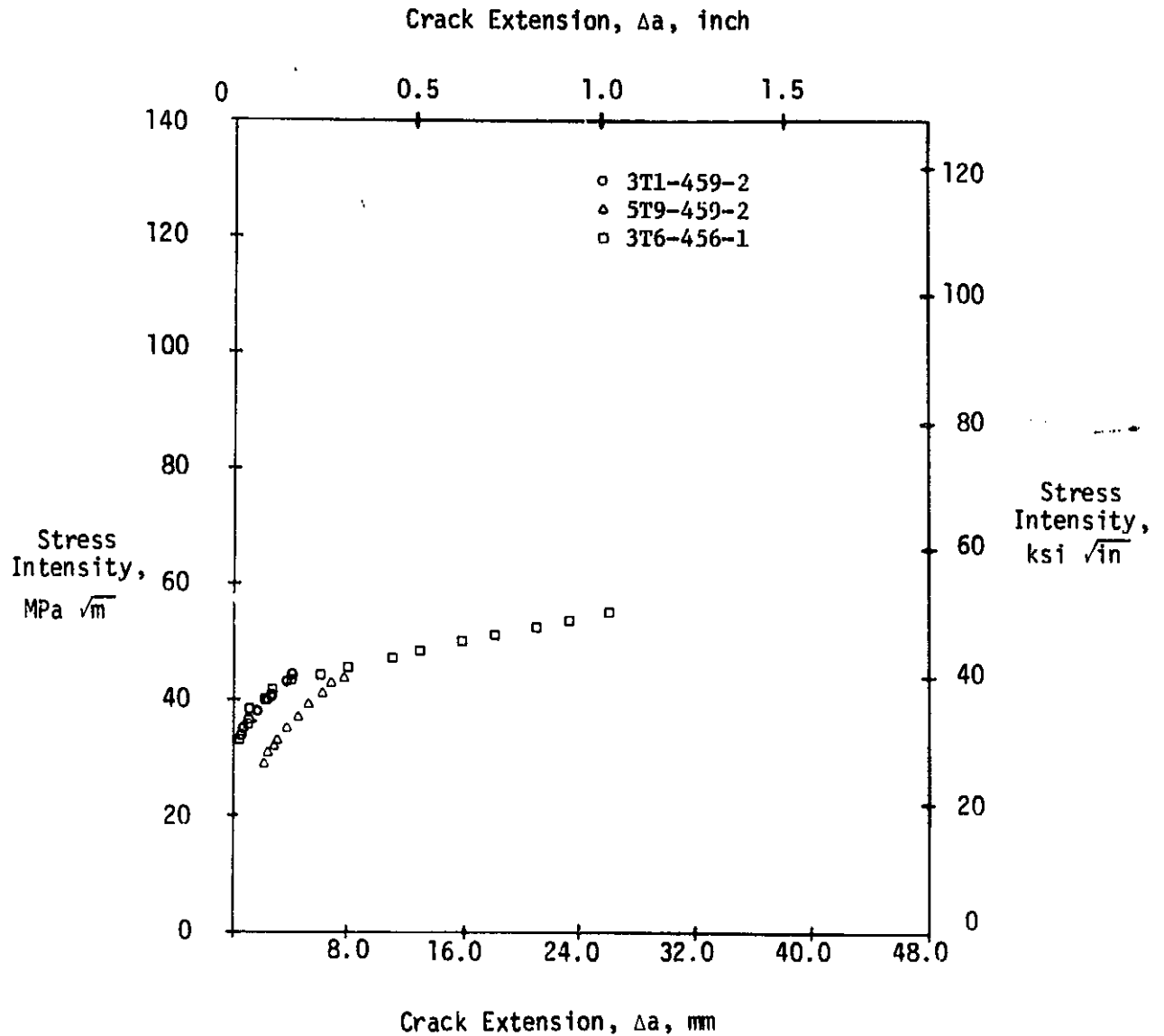
C-114

FIGURE C7-1

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 11.47 mm (.450 inch)

Orientation: Transverse

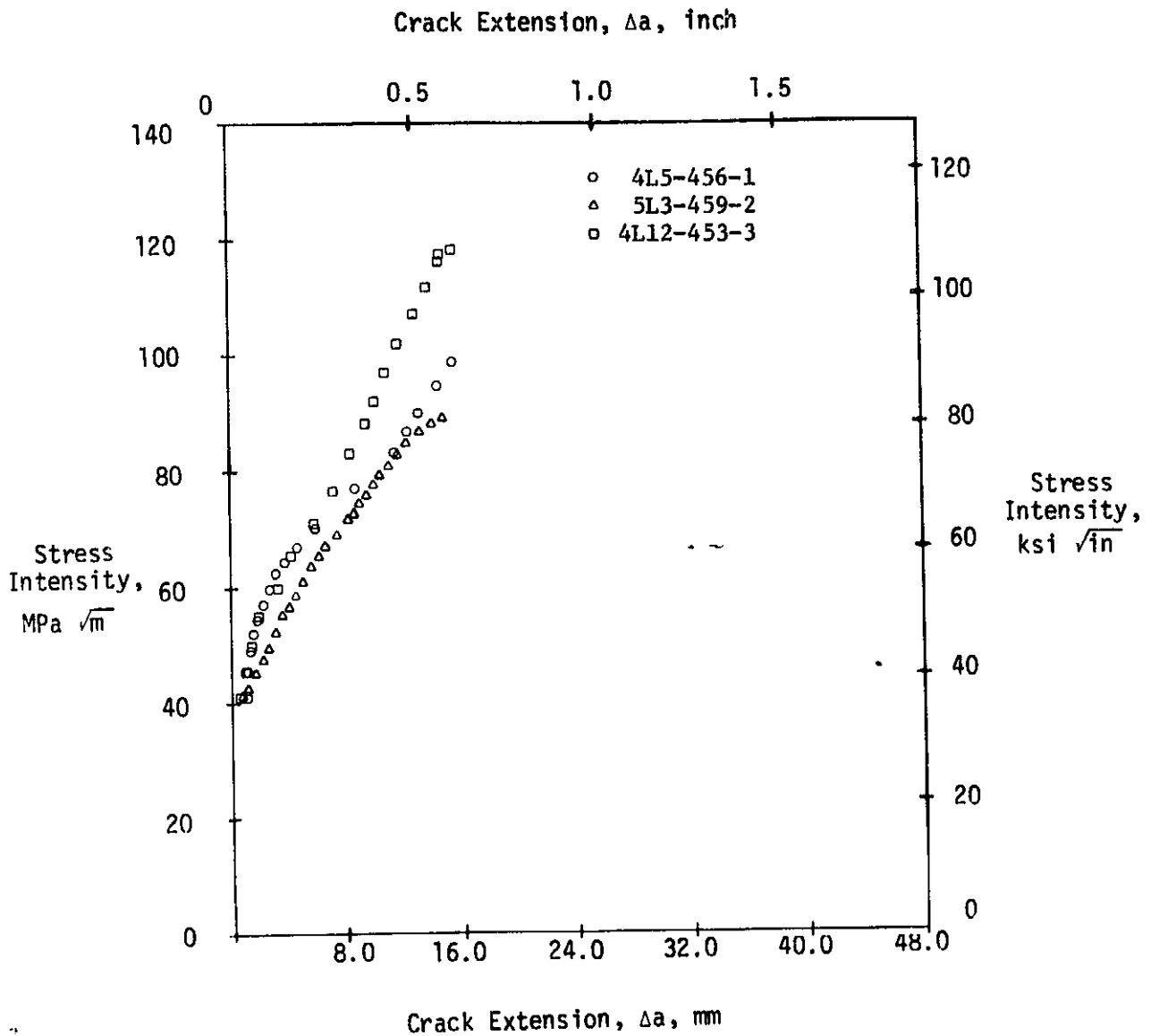
Temperature: 144°K (-200°F)

CRACK GROWTH RESISTANCE CURVE FOR 2124-T851

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 11.47 mm (.450 inch)

Orientation: Longitudinal

Temperature: 298°K (70°F)

CRACK GROWTH RESISTANCE CURVE FOR 2124-T851

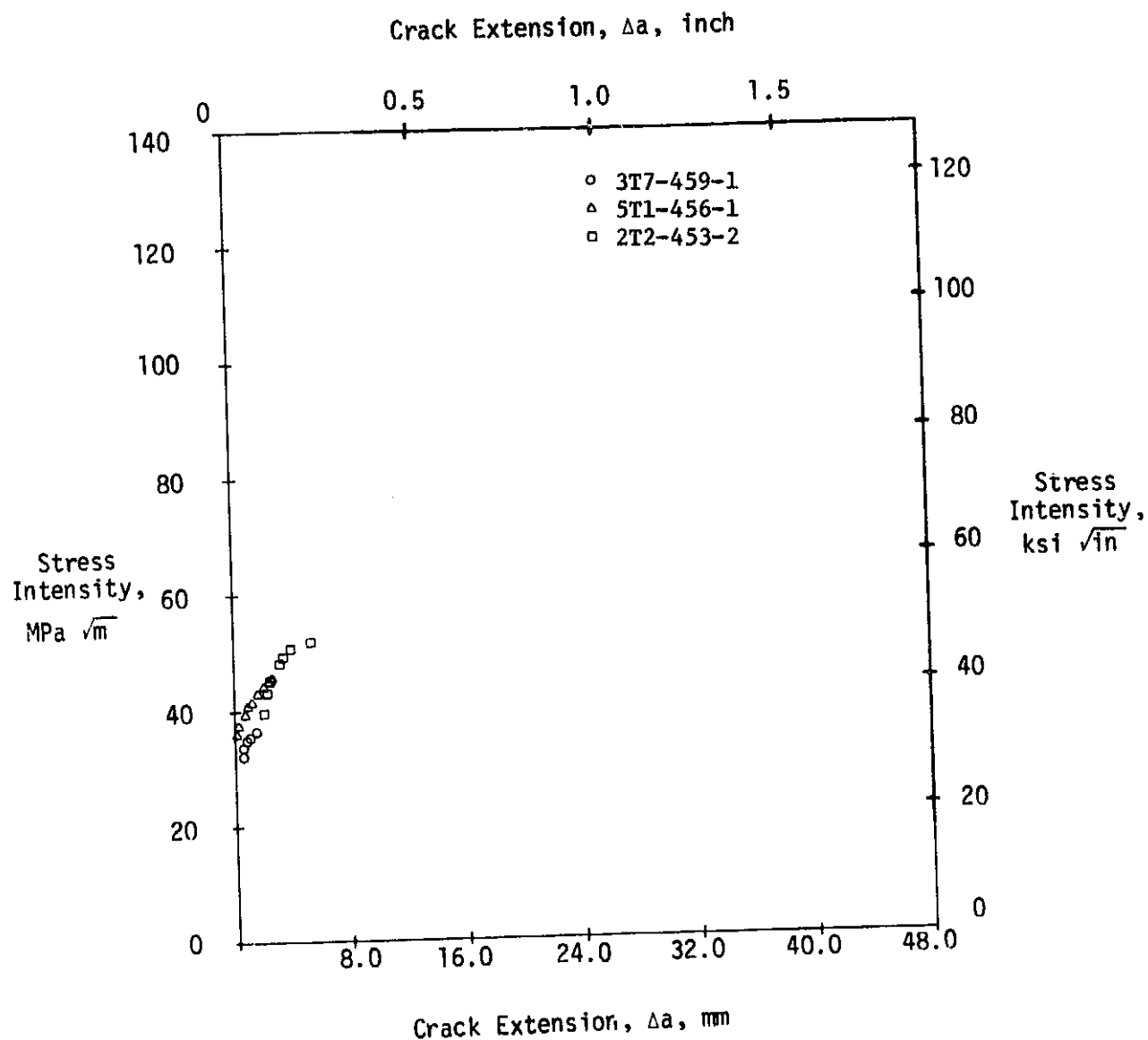
C-116

FIGURE C7-3

FINAL REPORT

MDC E1153
October 1974

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851



Thickness: 11.47 mm (.450 inch)

Orientation: Transverse

Temperature: 298°K (70°F)

CRACK GROWTH RESISTANCE CURVE FOR 2124-T851

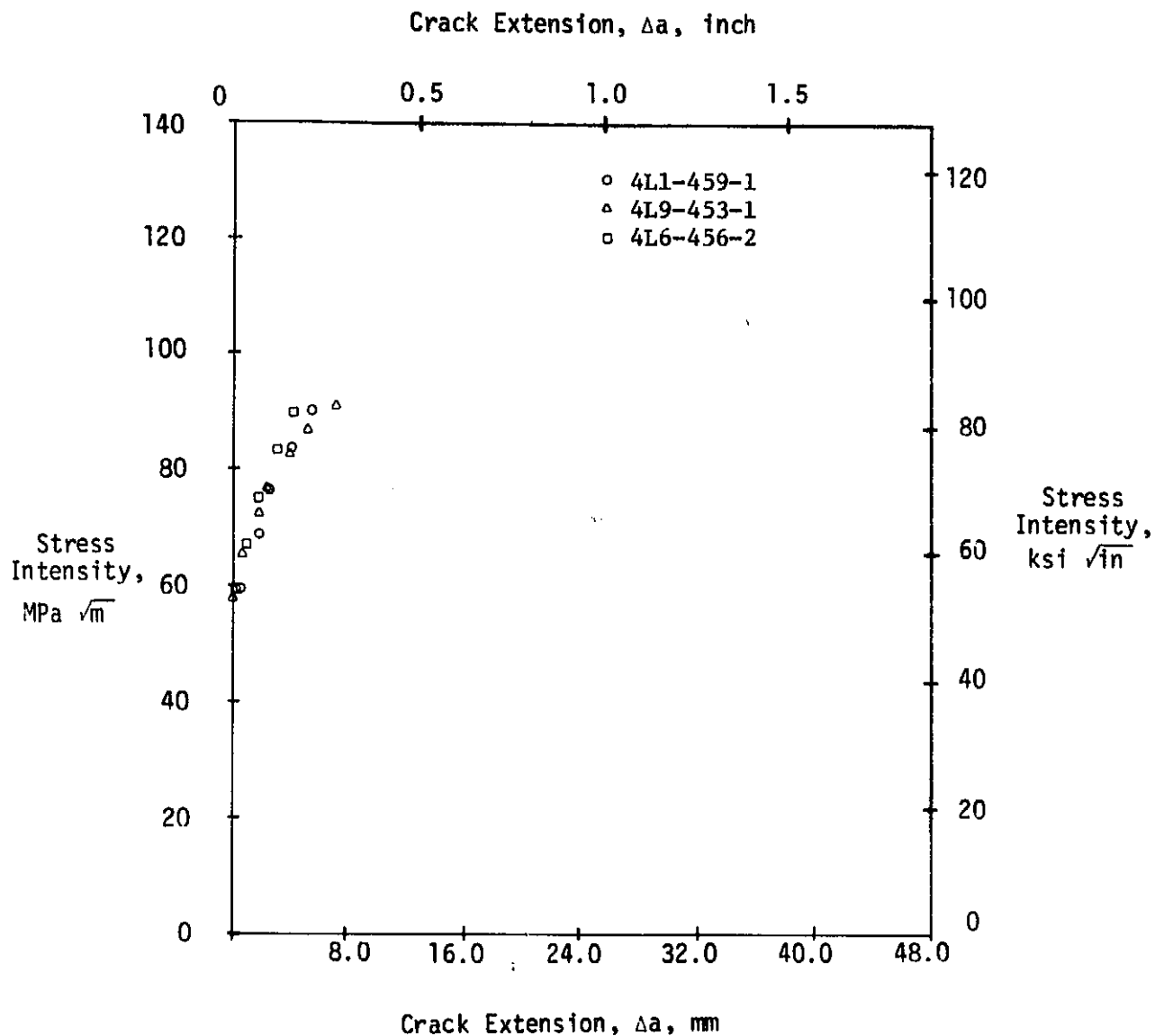
C-117

FIGURE C7-4

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 11.47 mm (.450 inch)

Orientation: Longitudinal

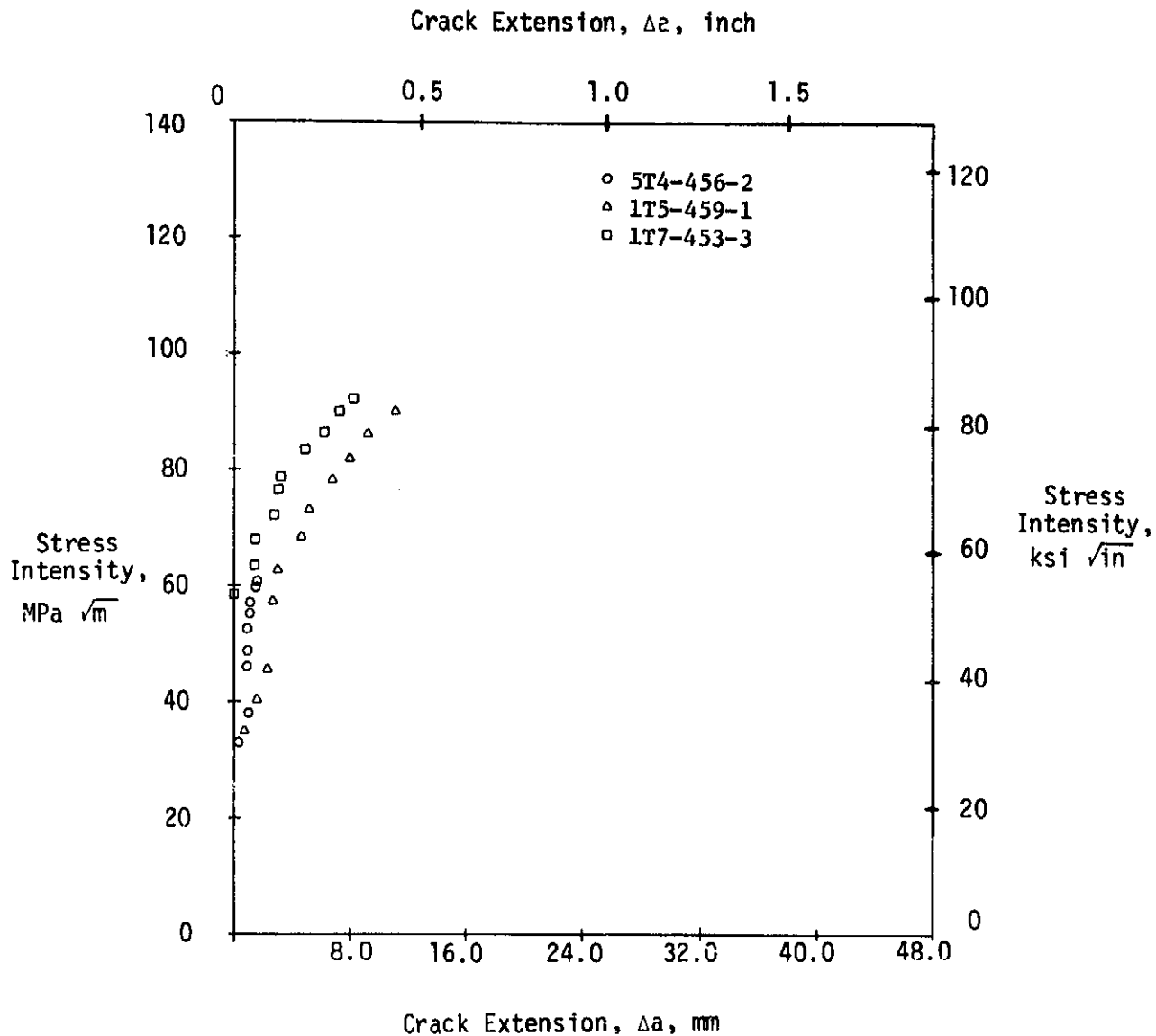
Temperature: 450°K (350°F)

CRACK GROWTH RESISTANCE CURVE FOR 2124-T851

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974



Thickness: 11.47 mm (.450 inch)

Orientation: Transverse

Temperature: 450°K (350°F)

CRACK GROWTH RESISTANCE CURVE FOR 2124-T851

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

NDC E1153
October 1974

Appendix D

CYCLIC FLAW GROWTH TEST DATA

This appendix presents all the cyclic flaw growth test data generated under the program. Because of the great quantity of data, it is divided into sections according to alloy, specimen thickness, and test frequency as follows:

<u>Section</u>	<u>Test Frequency (cpm)</u>	<u>Alloy</u>	<u>Nominal Specimen Thickness</u>	
			<u>mm</u>	<u>in</u>
D1	200	2024-T861	1.60	.063
D2	200	2024-T861	3.18	.125
D3	200	2024-T861	6.35	.250
D4	20	2024-T861 2124-T851	6.35	.250
D5	200	2124-T851	6.35	.250
D6	200	2124-T851	11.43	.450

The data in each section is presented in both graphical and tabular format. At the beginning of each section, a summary table is provided in order to correlate the tabulated specimen data with the appropriate graph. The data tables themselves consist of printed computer output in which the flaw growth rates are reported in modified scientific notation. That is, a flaw growth rate of $.7634 \times 10^{-3}$ mm/cycle is reported as .7634 E-3 mm/cycle, etc. The flaw growth rate (da/dN) and stress intensity (ΔK) data reported in the tables were obtained using the techniques described in Section 4.2.1. The data tables also designate which crack length/cycle number readings were obtained from 16mm motion picture film measurements; such data is preceded by the letter "F".

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**SECTION D1 - - FLAW GROWTH RATE DATA
FOR 1.60 mm (.063 INCH) THICK 2024-T861**

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TABLE D1-1. SUMMARY OF SPECIMEN TEST CONDITIONS FOR
200 CPM TESTS OF 1.60 mm (.063 INCH) 2024-T861

Test Temperature (°K)	Stress Ratio	Constraint	Test Direction	Specimen I.D.	Data Table No.	Figure No.
144 (N ₂)	.05	Stiffened	L	63-1L11	D1-2	D1-1(a)
				63-5L3	D1-3	D1-1(a)
			T	63-4T4	D1-4	D1-1(b)
				63-5T5	D-15	D1-1(b)
	.50	Stiffened	L	63-1L6	D1-6	D1-2(a)
				63-2L1	D1-7	D1-2(a)
			T	63-5T10	D1-8	D1-2(b)
				63-6T4	D1-9	D1-2(b)
	.05	Unstiffened	L	U63-5L1	D1-10	D1-3(a)
				U63-4L3	D1-11	D1-3(a)
			T	U63-5T9	D1-12	D1-3(b)
				U63-6T6	D1-13	D1-3(b)
298 (Argon)	.05	Stiffened	L	63-6L1	D1-14	D1-4(a)
				63-2L9	D1-15	D1-4(a)
				63-4L2	D1-16	D1-4(a)
			T	63-5T8	D1-17	D1-4(b)
	.50	Stiffened	L	63-3T2	D1-18	D1-4(b)
				63-6T8	D1-19	D1-4(b)
				63-2L6	D1-20	D1-5(a)
			T	63-1L13	D1-21	D1-5(a)
				63-2L10	D1-22	D1-5(a)
				63-3T7	D1-23	D1-5(b)
	.05	Unstiffened	L	63-4T1	D1-24	D1-5(b)
				63-3T11	D1-25	D1-5(b)
				U63-2L5	D1-26	D1-6(a)
				U63-2L2	D1-27	D1-6(a)
			T	U63-1L4	D1-28	D1-6(a)
				U63-4T2	D1-29	D1-6(b)
				63-5T8	D1-30	D1-6(b)
				U63-4T3	D1-31	D1-6(b)
				U63-3T5	D1-32	D1-6(b)

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TABLE D1-1 (CONTINUED)

<u>Test Temperature (°K)</u>	<u>Stress Ratio</u>	<u>Constraint</u>	<u>Test Direction</u>	<u>Specimen I.D.</u>	<u>Data Table No.</u>	<u>Figure No.</u>
298 (Wet Air)	.05	Unstiffened	L	U63-2L12	D1-33	D1-6(a)
				U63-3L1	D1-34	D1-6(a)
				U63-2L13	D1-35	D1-6(a)
			T	U63-5T2	D1-36	D1-6(b)
				U63-5T6	D1-37	D1-6(b)
				U63-3T3	D1-38	D1-6(b)
422	.05	Stiffened	L	63-3L3	D1-39	D1-7(a)
				63-2L7	D1-40	D1-7(a)
			T	63-4T9	D1-41	D1-7(b)
				63-5T4	D1-42	D1-7(b)
		Unstiffened	L	U63-4L1	D1-43	D1-9(a)
			T	U63-5T3	D1-44	D1-10
	.05	Stiffened	L	63-1L15	D1-45	D1-7(a)
				63-6L4	D1-46	D1-7(a)
			T	63-3T12	D1-47	D1-7(b)
				63-1T1	D1-48	D1-7(b)
		Stiffened	L	63-1L1	D1-49	D1-8(a)
				63-2L15	D1-50	D1-8(a)
			T	63-4T7	D1-51	D1-8(b)
				63-3T10	D1-52	D1-8(b)
	.05	Unstiffened	L	U63-3L4	D1-53	D1-9(a)
				U63-1L9	D1-54	D1-9(a)
			T	U63-6T3	D1-55	D1-9(b)
				U63-5T7	D1-56	D1-9(b)
478	.05	Stiffened	L	63-1L8	D1-57	D1-7(a)
				63-6L3	D1-58	D1-7(a)
			T	63-4T6	D1-59	D1-7(b)
				63-4T12	D1-60	D1-7(b)
		Unstiffened	L	U63-1L5	D1-61	D1-9(a)
			T	U63-4T8	D1-62	D1-9(b)

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TABLE D1-2

SPECIMEN NUMBER: 63-1111
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: STIFFENED
ENVIRONMENT: NITROGEN
TEST TEMPERATURE: 164.0 K
SPECIMEN THICKNESS: 1.65 MM (0.0650 IN)
MAXIMUM STRESS: 114.5 MPA (17.2 KSI)
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 5845 CYCLES
K(MAX): 1 CYCLES PRIOR TO FAILURE: 60.80 MPA SORT(M); 55.33 KSI SORT(M)

CRACK LENGTH MM	IN	CYCLES	DELTA (K)/DELTA (M) MM/CYCLE	IN/CYCLE	DELTA (STRESS INTENSITY) MPA SORT(M)	KSI SORT(M)
8.32	.328	1	.7634E-03	.3006E-04	18.61	16.93
8.94	.354	896	.9144E-03	.3600E-04	19.14	17.42
9.31	.367	1236	.1144E-02	.4447E-04	19.65	17.89
9.94	.394	1421	.1351E-02	.5319E-04	20.23	18.41
11.45	.451	2166	.1751E-02	.6892E-04	20.84	18.96
11.21	.441	2402	.1993E-02	.7833E-04	21.46	19.53
11.75	.462	2472	.2259E-02	.8994E-04	22.07	20.09
12.51	.493	3211	.2852E-02	.1123E-03	22.67	20.63
13.05	.514	3734	.2832E-02	.1115E-03	23.24	21.15
13.80	.541	4661	.4215E-02	.1674E-03	23.82	21.68
14.38	.566	5401	.2939E-02	.1145E-03	24.38	22.19
14.11	.550	4152	.4418E-02	.1739E-03	24.91	22.67
15.63	.616	4171	.3969E-02	.1562E-03	25.35	23.07
16.17	.637	4117	.5673E-02	.2236E-03	25.90	23.57
16.94	.660	4449	.4614E-02	.1817E-03	26.42	24.04
17.48	.689	4554	.6079E-02	.2377E-03	26.90	24.48
18.21	.716	4674	.6495E-02	.2597E-03	27.48	25.01
19.00	.749	4739	.7308E-02	.2877E-03	28.25	25.71
20.22	.796	4966	.4171E-02	.3217E-03	29.14	26.51
21.38	.847	5134	.9471E-02	.3729E-03	30.09	27.38
22.83	.899	5252	.1376E-01	.5263E-03	31.07	28.27
24.14	.950	5361	.1223E-01	.4813E-03	31.88	29.01
25.16	.990	5443	.1954E-01	.7694E-03	32.67	29.73
26.47	1.042	5510				
27.79	1.094	5564	.2354E-01	.9269E-03	33.56	30.54
29.14	1.147	5611	.3033E-01	.1181E-02	34.45	31.15
F 30.10	1.185	5645	.2935E-01	.1114E-02	35.21	32.04
F 31.67	1.246	5739	.3344E-01	.1200E-02	36.02	32.78
F 32.83	1.295	5725	.4213E-01	.1667E-02	36.92	33.60
F 34.04	1.340	5753	.4572E-01	.1800E-02	37.69	34.38
F 35.66	1.401	5771	.7623E-01	.3000E-02	38.94	35.37
F 36.58	1.440	5785	.6773E-01	.2667E-02	39.34	35.80
F 37.85	1.490	5795	.1270E+00	.5600E-02	40.05	36.45
F 39.62	1.556	5805	.1778E+00	.7000E-02	41.00	37.31
F 41.27	1.625	5815	.1651E+00	.6500E-02	42.07	38.28
F 42.80	1.695	5823	.3048E+00	.1200E-01	43.05	39.18
F 44.45	1.750	5835	.3302E+00	.1300E-01	44.04	40.08
F 46.46	1.845	5833	.4826E+00	.1900E-01	45.30	41.22
F 48.51	1.910	5833	.5503E+00	.2167E-01	46.56	42.37
F 49.91	1.964	5835	.6989E+00	.2753E-01	47.51	43.24
F 51.67	2.040	5837	.9425E+00	.3750E-01	48.55	44.18
F 53.07	2.125	5839	.1079E+01	.4250E-01	49.83	45.37
F 55.12	2.170	5840	.1143E+01	.4500E-01	50.89	46.31
F 56.51	2.225	5841	.1397E+01	.5500E-01	51.70	47.05
F 58.67	2.310	5842	.2159E+01	.8500E-01	52.86	48.10
F 60.48	2.400	5843	.3810E+01	.1500E+00	54.83	49.89
F 64.90	2.555	5944	.2413E+01	.9500E-01	56.93	51.81

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TABLE D1-3

SPECIMEN NUMBER: 63-SL1				2024-T861		
ALLOY TYPE: 2024-T861				LONGITUDINAL		
SPECIMEN ORIENTATION: LONGITUDINAL				STIFFENED		
CONSTRAINT: STIFFENED				NITROGEN		
TEST ENVIRONMENT: NITROGEN				144.5 K		
TEST TEMPERATURE: 144.5 K				1.64 MM (0.064 IN)		
SPECIMEN THICKNESS: 1.64 MM (0.064 IN)				168.9 MPA (24.5 KSI)		
MAXIMUM STRESS: 168.9 MPA (24.5 KSI)				200 CPM		
FREQUENCY: 200 CPM				3349 CYCLES		
CYCLES TO FAILURE: 3349 CYCLES				K(MAX) 179 CYCLES PRIOR TO FAILURE: 35.41 MPA SQRT(M) (32.22 KSI SQRT(IN))		
CRACK LENGTH MM	IN	CYCLES	DELTA(A)/DELTA(M) MM/CYCLE	IN/CYCLE	DELTA(Stress Intensity) MPA SQRT(M)	KSI SQRT(IN)
4.42	.174	1	.1139E-02	.4473E-04	20.00	14.20
5.45	.215	922	.1999E-02	.7517E-04	21.81	15.85
6.49	.259	1341	.2217E-02	.8713E-04	23.32	17.20
7.12	.279	1707	.2259E-02	.8878E-04	24.90	18.29
7.69	.303	1973	.3141E-02	.1252E-03	25.76	19.44
8.66	.341	2271	.3934E-02	.1550E-03	27.63	20.59
9.32	.367	2442	.6965E-02	.2742E-03	28.22	21.50
9.94	.391	2537	.5262E-02	.2040E-03	29.00	22.39
10.68	.421	2669	.7644E-02	.3009E-03	30.06	22.75
11.41	.453	2777	.1062E-01	.4141E-03	31.21	23.40
12.39	.494	2961	.1155E-01	.4589E-03	32.30	24.10
13.14	.519	3074	.1566E-01	.6167E-03	33.22	25.24
13.84	.545	3197				

TABLE D1-4

SPECIMEN NUMBER: 63-AT4				2024-T861		
ALLOY TYPE: 2024-T861				TRANSVERSE		
SPECIMEN ORIENTATION: TRANSVERSE				STIFFENED		
CONSTRAINT: STIFFENED				NITROGEN		
TEST ENVIRONMENT: NITROGEN				144.5 K		
TEST TEMPERATURE: 144.5 K				1.27 MM (0.050 IN)		
SPECIMEN THICKNESS: 1.27 MM (0.050 IN)				117.7 MPA (17.0 KSI)		
MAXIMUM STRESS: 117.7 MPA (17.0 KSI)				200 CPM		
FREQUENCY: 200 CPM				3241 CYCLES		
CYCLES TO FAILURE: 3241 CYCLES				K(MAX) 168 CYCLES PRIOR TO FAILURE: 32.56 MPA SQRT(M) (29.63 KSI SQRT(IN))		
CRACK LENGTH MM	IN	CYCLES	DELTA(A)/DELTA(M) MM/CYCLE	IN/CYCLE	DELTA(Stress Intensity) MPA SQRT(M)	KSI SQRT(IN)
8.38	.330	1	.1210E-02	.4765E-04	18.60	16.93
8.90	.350	427	.1508E-02	.5938E-04	19.29	17.96
9.68	.381	944	.2704E-02	.1065E-03	19.94	18.15
10.16	.400	1322	.2115E-02	.8325E-04	20.40	18.96
10.58	.416	1319	.1856E-02	.7306E-04	20.77	18.90
10.91	.430	1499	.1077E-02	.4241E-04	20.97	19.08
11.00	.433	1578	.1957E-02	.7703E-04	21.21	19.30
11.40	.449	1707	.4944E-02	.1947E-03	21.84	19.88
12.33	.485	1974	.5941E-02	.2142E-03	22.59	20.56
13.04	.513	2104	.3486E-02	.1372E-03	23.14	21.06
13.56	.534	2253	.7419E-02	.2921E-03	23.74	21.60
14.40	.567	2367	.8959E-02	.3527E-03	24.39	22.19
15.06	.593	2441	.1033E-01	.4009E-03	24.96	22.72
15.78	.621	2510	.5772E-02	.2272E-03	25.50	23.20
16.36	.644	2611	.8547E-02	.3365E-03	25.99	23.65
16.99	.669	2885	.9472E-02	.3729E-03	26.60	24.21
17.90	.705	2781	.9777E-02	.3849E-03	27.20	24.75
18.52	.729	2844	.1203E-01	.4736E-03	27.77	25.27
19.38	.763	2916	.1905E-01	.7512E-03	28.47	25.91
20.37	.802	2964	.2405E-01	.1126E-02	29.31	26.67
21.45	.852	3017	.2442E-01	.1135E-02	30.34	27.62
23.27	.916	3277				

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TABLE D1-5

SPECIMEN NUMBER: 63-575 ALLOY TYPE: 2024-T861 SPECIMEN ORIENTATION: TRANSVERSE CONSTRAINT: STIFFENED ENVIRONMENT: NITROGEN TEST TEMPERATURE: 144.0 K SPECIMEN THICKNESS: 1.64 MM (0.0647 IN) MAXIMUM STRESS: 164.9 MPA (23.9 KSI) R-RATIO: 0.5 FREQUENCY: 200 CPN CYCLES TO FAILURE: 1773 CYCLES K(MAX): 42 CYCLES PRIOR TO FAILURE: 35.60 MPA SQRT(M) (32.40 KSI SQRT(IN))					
CRACK LENGTH MM	IN	CYCLES	DELTA(A)/DELTA(M) MM/CYCLE	IN/CYCLE	DELTA(Stress Intensity) MPA SQRT(M) KSI SQRT(IN)
4.15	.175	1	.1399E-02	.5589E-04	19.29
5.20	.205	541	.2691E-02	.1060E-03	20.95
6.17	.243	902	.3719E-02	.1463E-03	22.44
6.67	.270	1089	.5202E-02	.2018E-03	23.75
7.74	.305	1256	.5984E-02	.2356E-03	25.01
8.44	.332	1374	.8210E-02	.3232E-03	26.34
9.49	.373	1581	.1232E-01	.4850E-03	27.97
10.72	.422	1601	.1690E-01	.6655E-03	29.45
11.65	.459	1656	.3479E-01	.1378E-02	31.83
13.14	.517	1699	.4778E-01	.1881E-02	32.91
14.67	.578	1731			

TABLE D1-6

SPECIMEN NUMBER: 63-116 ALLOY TYPE: 2024-T861 SPECIMEN ORIENTATION: LONGITUDINAL CONSTRAINT: STIFFENED ENVIRONMENT: NITROGEN TEST TEMPERATURE: 144.0 K SPECIMEN THICKNESS: 1.65 MM (0.0650 IN) MAXIMUM STRESS: 110.6 MPA (15.9 KSI) R-RATIO: 0.5 FREQUENCY: 200 CPN CYCLES TO FAILURE: 3283 CYCLES K(MAX): 95 CYCLES PRIOR TO FAILURE: 45.20 MPA SQRT(M) (41.14 KSI SQRT(IN))					
CRACK LENGTH MM	IN	CYCLES	DELTA(A)/DELTA(M) MM/CYCLE	IN/CYCLE	DELTA(Stress Intensity) MPA SQRT(M) KSI SQRT(IN)
9.91	.391	1	.1995E-03	.7813E-05	10.68
10.42	.411	3495	.2977E-03	.1172E-04	11.11
11.61	.457	4788	.3727E-03	.1467E-04	11.55
12.43	.488	8935	.4702E-03	.1851E-04	11.97
13.31	.524	12877	.5641E-03	.2221E-04	12.49
14.27	.562	12973	.6113E-03	.2405E-04	12.83
15.19	.598	14075	.7813E-03	.3075E-04	13.26
16.25	.643	15436	.9500E-03	.3772E-04	13.64
16.97	.664	16199	.1126E-02	.4431E-04	13.98
17.83	.702	16954	.1511E-02	.5950E-04	14.39
18.97	.747	17727	.1343E-02	.5367E-04	14.98
19.77	.779	19042	.2135E-02	.8436E-04	15.61
22.21	.874	19727	.2383E-02	.9372E-04	16.23
24.07	.944	20495	.3097E-02	.1219E-03	16.89
25.81	1.016	21051	.4443E-02	.1744E-03	17.58
27.95	1.103	21533	.4492E-02	.1924E-03	18.26
29.72	1.169	21931	.7244E-02	.2892E-03	18.92
31.76	1.250	22175	.1224E-01	.4849E-03	19.65
34.03	1.342	22344	.1253E-01	.4913E-03	20.31
35.71	1.406	22511	.2073E-01	.8161E-03	20.91
37.44	1.482	22623	.3264E-01	.1245E-02	21.56
39.69	1.563	22665	.4142E-01	.1631E-02	22.25
41.45	1.647	22714			

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TABLE D1-7

SPECIMEN NUMBER: 63-2L1
ALLOY TYPE: 2124-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: STIFFENED
ENVIRONMENT: NITROGEN
TEST TEMPERATURE: 144.0 K
SPECIMEN THICKNESS: 1.53 MM (0.060 IN)
MAXIMUM STRESS: 168.9 MPA (24.5 KSI)
R-RATIO: .50
FREQUENCY: 280 CPM
CYCLES TO FAILURE: 18847 CYCLES
KIMAX, 200 CYCLES PRIOR TO FAILURE: 46.20 MPA SORT(M); 42.04 KSI SORT(IN)

CRACK LENGTH MM	IN	CYCLES	DELTA(A)/DELTA(B) MM/CYCLE	IN/CYCLE	DELTA(1STRESS) MPA SORT(M)	INTENSITY KSI SORT(IN)
6.51	.256	2412	.3113E-03	.1224E-04	11.73	10.68
7.14	.312	5153	.4433E-03	.1744E-04	12.62	11.49
7.76	.345	6144	.9744E-03	.3916E-04	13.59	12.37
9.41	.412	6743	.9997E-03	.3936E-04	14.29	13.01
11.21	.432	7426	.1254E-02	.4993E-04	14.86	13.52
11.06	.435	7865	.1915E-02	.7540E-04	15.48	14.08
11.94	.470	9391	.1F94E-02	.6657E-04	16.10	14.65
12.03	.469	8436	.2221E-02	.8744E-04	16.76	15.25
13.94	.549	7233	.2534E-02	.9975E-04	17.43	15.86
15.15	.593	9545	.1572E-02	.1409E-03	18.12	16.49
16.31	.642	9836	.4342E-02	.1710E-03	18.87	17.17
17.45	.687	10051	.7269E-02	.2074E-03	19.59	17.93
18.92	.745	10294	.6173E-02	.2391E-03	20.36	18.53
19.77	.778	10375	.1340E-01	.4093E-03	21.03	19.14
21.80	.822	10443	.8975E-02	.3534E-03	21.56	19.62
21.66	.853	10551	.1464E-01	.5763E-03	22.08	20.10
22.41	.882	10617	.1124E-01	.4443E-03	22.51	20.49
23.13	.916	10647	.2375E-01	.9350E-03	22.91	20.95

TABLE D1-8

SPECIMEN NUMBER: 63-5Y10
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINT: STIFFENED
ENVIRONMENT: NITROGEN
TEST TEMPERATURE: 144.0 K
SPECIMEN THICKNESS: 1.66 MM (0.065 IN)
MAXIMUM STRESS: 118.0 MPA (17.2 KSI)
R-RATIO: .50
FREQUENCY: 280 CPM
CYCLES TO FAILURE: 9744 CYCLES
KIMAX, 62 CYCLES PRIOR TO FAILURE: 41.17 MPA SORT(M); 37.47 KSI SORT(IN)

CRACK LENGTH MM	IN	CYCLES	DELTA(A)/DELTA(B) MM/CYCLE	IN/CYCLE	DELTA(1STRESS) MPA SORT(M)	INTENSITY KSI SORT(IN)
10.39	.409	1942	.3945E-03	.1569E-04	10.95	9.96
11.95	.470	3223	.6167E-03	.2428E-04	11.34	10.32
12.62	.497	4180	.6980E-03	.2748E-04	11.70	10.65
13.45	.530	4856	.1232E-02	.4852E-04	12.66	10.97
14.64	.577	5629	.1543E-02	.6074E-04	12.53	11.40
15.54	.612	6343	.1258E-02	.4951E-04	13.00	11.83
16.37	.644	6812	.1763E-02	.6940E-04	13.37	12.17
17.12	.674	7120	.2441E-02	.9617E-04	13.71	12.40
17.91	.705	7435	.2500E-02	.9841E-04	14.03	12.77
18.83	.741	7777	.2707E-02	.1066E-03	14.38	13.09
19.68	.775	8043	.3172E-02	.1248E-03	14.74	13.41
21.44	.844	8463	.4191E-02	.1650E-03	15.25	13.88
23.09	.909	8764	.5477E-02	.2156E-03	15.90	14.47
25.14	.990	9095	.6244E-02	.2443E-03	16.99	15.10
27.51	1.083	9259	.1445E-01	.5649E-03	17.39	15.83
29.87	1.176	9451	.1230E-01	.4841E-03	18.22	16.58
31.23	1.228	9572	.1095E-01	.4310E-03	18.86	17.16
32.93	1.297	9636	.719E-01	.1070E-02	19.38	17.64
35.87	1.404	9692	.5452E-01	.2343E-02	20.13	18.32

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TABLE D1-9

SPECIMEN NUMBER: 63-6T4
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINT: STIFFENED
ENVIRONMENT: NITROGEN
TEST TEMPERATURE: 844.0 K
SPECIMEN THICKNESS: 1.65 MM (0.0650 IN)
MAXIMUM STRESS: 164.8 MPA (23.9 KSI)
FREQUENCY: 200 CPH
CYCLES TO FAILURE: 4892 CYCLES
K(MAX): 45 CYCLES PRIOR TO FAILURE 42.22 MPA SQRT(M) (38.42 KSI SQRT(IN))

CRACK LENGTH MM IN		CYCLES	DELTA(K)/DELTA(IN) MM/CYCLE IN/CYCLE	DELTA(STRESS INTENSITY) MPA SQRT(M) KSI SQRT(IN)		
5.81	.229	1	.5475E-03	.2155E-04	11.55	10.51
6.68	.263	1590	.1399E-02	.5507E-04	12.41	11.29
7.72	.304	2343	.1289E-02	.5076E-04	13.35	12.15
8.92	.351	3266	.2228E-02	.0771E-04	14.18	12.91
9.85	.388	3685	.3270E-02	.1267E-03	14.83	13.50
10.66	.420	3932	.5353E-02	.2108E-03	15.48	14.09
11.65	.459	4118	.6988E-02	.2751E-03	16.29	14.82
13.02	.513	4313	.6047E-02	.2381E-03	17.00	15.47
13.80	.543	4443	.9552E-02	.3761E-03	17.93	15.96
14.70	.579	4537	.1468E-01	.5781E-03	18.14	16.51
15.77	.621	4610	.9366E-02	.3688E-03	18.76	17.07
16.75	.659	4714	.2554E-01	.1005E-02	19.40	17.65
17.95	.707	4761	.1690E-01	.6652E-03	20.07	18.27
19.11	.752	4833	.7627E-01	.3003E-02	20.76	18.89
20.41	.804	4847				

TABLE D1-10

SPECIMEN NUMBER: 063-5L1
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
ENVIRONMENT: NITROGEN
TEST TEMPERATURE: 844.0 K
SPECIMEN THICKNESS: 1.65 MM (0.0650 IN)
MAXIMUM STRESS: 118.6 MPA (17.2 KSI)
FREQUENCY: 200 CPH
CYCLES TO FAILURE: 6319 CYCLES
K(MAX): 11.0 CYCLES PRIOR TO FAILURE 38.94 MPA SQRT(M) (35.43 KSI SQRT(IN))

CRACK LENGTH MM IN		CYCLES	DELTA(K)/DELTA(IN) MM/CYCLE IN/CYCLE	DELTA(STRESS INTENSITY) MPA SQRT(M) KSI SQRT(IN)		
8.43	.331		.6294E-03	.2478E-04	18.96	17.26
9.54	.376	1629	.1279E-02	.5035E-04	20.13	18.32
10.65	.419	2673	.1372E-02	.5402E-04	21.09	19.19
11.50	.453	3295	.2593E-02	.1023E-03	21.90	19.93
12.34	.486	3819	.2966E-02	.1168E-03	22.66	20.62
13.15	.518	3833	.2801E-02	.1103E-03	23.49	21.38
14.22	.560	4272	.3547E-02	.1397E-03	24.30	22.12
15.04	.592	4504	.3791E-02	.1493E-03	24.97	22.72
16.80	.622	4705	.3857E-02	.1518E-03	25.72	23.40
18.05	.664	4974	.5592E-02	.2202E-03	26.39	24.02
17.49	.689	5092	.6906E-02	.2719E-03	26.93	24.51
18.22	.717	5197	.6388E-02	.2483E-03	27.51	25.03
18.98	.747	5318	.6894E-02	.2714E-03	28.38	25.83
20.52	.800	5542	.8853E-02	.3485E-03	29.51	26.86
22.04	.868	5713	.1268E-01	.6992E-03	30.62	27.86
23.60	.929	5836	.1488E-01	.9860E-03	31.63	28.79
24.92	.981	5929	.1923E-01	.7572E-03	32.73	29.79
26.79	1.055	6022	.2271E-01	.8940E-03	34.06	31.00
28.08	1.137	6114	.3124E-01	.1238E-02	35.34	32.15
30.66	1.207	6171	.4183E-01	.2841E-02	36.46	33.18
32.32	1.272	6293				

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TABLE D1-11

SPECIMEN NUMBER: U63-413			
ALLOY TYPE: 2024-T861			
SPECIMEN ORIENTATION: LONGITUDINAL			
CONSTRAINT: UNSTIFFENED			
ENVIRONMENT: NITROGEN			
TEST TEMPERATURE: 144.0 K			
SPECIMEN THICKNESS: 1.66 MM (1.053 IN)			
MAXIMUM STRESS: 164.9 MPA (24.0 KSI)			
R-RATIO: 0.05			
FREQUENCY: 200 CPM			
CYCLES TO FAILURE: 1620 CYCLES			
K(MAX) 135 CYCLES PRIOR TO FAILURE: 40.63 MPA SQRT(M) (37.15 KSI SQRT(IN))			
CRACK LENGTH MM IN	CYCLES	DELTA(KA)/DELTA(IN) MM/CYCLE IN/CYCLE	DELTA(STRESS INTENSITY) MPA SQRT(M) KSI SQRT(IN)
4.31 .171	1	.0044E-03 .3478E-04	19.56 17.00
5.11 .201	873	.1337E-02 .5263E-04	21.15 19.24
6.92 .273	1401	.2104E-02 .8205E-04	22.96 20.96
7.07 .274	2029	.3118E-02 .1228E-03	24.73 22.66
7.96 .314	2321	.7777E-02 .1447E-03	26.26 23.90
8.99 .354	2587	.9357E-02 .2109E-03	27.86 25.36
11.69 .464	2793	.6463E-02 .2523E-03	29.54 26.88
11.33 .446	2956	.7295E-02 .2872E-03	31.05 28.25
12.33 .494	3117	.1049E-01 .4132E-03	32.34 29.43
13.37 .523	3214	.1244E-01 .5154E-03	33.97 30.95
14.26 .561	3284	.1733E-01 .6824E-03	34.87 31.73
14.41 .577	3356	.1817E-01 .7154E-03	36.13 32.88
16.37 .645	3434	.1995E-01 .7857E-03	37.40 34.13
17.43 .694	3471	.4363E-01 .1718E-02	38.45 34.99
18.74 .748	3495		

TABLE D1-12

SPECIMEN NUMBER: U63-579			
ALLOY TYPE: 2024-T861			
SPECIMEN ORIENTATION: TRANSVERSE			
CONSTRAINT: UNSTIFFENED			
ENVIRONMENT: NITROGEN			
TEST TEMPERATURE: 144.0 K			
SPECIMEN THICKNESS: 1.66 MM (1.053 IN)			
MAXIMUM STRESS: 164.9 MPA (23.9 KSI)			
R-RATIO: 0.05			
FREQUENCY: 200 CPM			
CYCLES TO FAILURE: 1383 CYCLES			
K(MAX) 116 CYCLES PRIOR TO FAILURE: 32.12 MPA SQRT(M) (29.23 KSI SQRT(IN))			
CRACK LENGTH MM IN	CYCLES	DELTA(KA)/DELTA(IN) MM/CYCLE IN/CYCLE	DELTA(STRESS INTENSITY) MPA SQRT(M) KSI SQRT(IN)
4.70 .189	1	.1906E-02 .7509E-04	20.01 18.21
5.68 .224	516	.3561E-02 .1402E-03	21.84 19.88
6.60 .263	796	.5463E-02 .2191E-03	23.34 21.24
7.42 .292	932	.8943E-02 .3921E-03	24.64 22.42
8.20 .326	1028	.9039E-02 .3959E-03	26.18 23.83
9.44 .371	1156	.1778E-01 .7000E-03	27.84 25.34
10.57 .416	1220	.3138E-01 .1236E-02	29.59 26.93
11.99 .472	1265		

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TABLE D1-13

SPECIMEN NUMBER: ALLOY TYPE: SPECIMEN ORIENTATION: CONSTRAINT: ENVIRONMENT: TEST TEMPERATURE: SPECIMEN THICKNESS: MAXIMUM STRESS: R-RATIO: FREQUENCY: CYCLES TO FAILURE: CYCLES PRIOR TO FAILURE:							063-679 2024-T861 TRANSVERSE UNSTRESSSED NITROGEN 144.8 IN 1.65 MM (0.065 IN) 118.5 MPA (17.2 KSI) 200 CPM 3083 CYCLES 51.60 MPA SQRT(M) (46.96 KSI SQRT(IN))	
K(MAX)	1	CYCLES	DELTA (A)/DELTA (N) MM/CYCLE	IN/CYCLE	DELTA (STRESS INTENSITY) MPA SQRT(M)	KSI SQRT(IN)		
	8.47	.333						
	9.25	.364	602	.1300E-02	.5116E-04	10.83	17.44	
	10.41	.410	1171	.2051E-02	.8076E-04	19.05	18.07	
	11.43	.450	1539	.2761E-02	.1087E-03	20.94	19.05	
	12.52	.493	1852	.3477E-02	.1369E-03	21.94	19.97	
	13.58	.535	2093	.4393E-02	.1728E-03	22.92	20.86	
	14.55	.573	2241	.6593E-02	.2595E-03	23.81	21.67	
	15.66	.617	2405	.6768E-02	.2665E-03	24.70	22.48	
	16.76	.660	2523	.9267E-02	.3648E-03	25.61	23.31	
	18.64	.710	2634	.1157E-01	.4554E-03	26.56	24.17	
	19.30	.760	2735	.1244E-01	.4896E-03	27.55	25.07	
	20.00	.788	2771	.1968E-01	.7750E-03	28.30	25.75	
	21.59	.850	2842	.2236E-01	.8803E-03	29.15	26.53	
	22.48	.885	2883	.2165E-01	.8524E-03	30.05	27.35	
F	23.37	.928	2913	.2963E-01	.1187E-02	30.68	27.92	
F	24.26	.955	2934	.3956E-01	.1400E-02	31.31	28.49	
F	25.78	1.015	2961	.6096E-01	.2400E-02	32.15	29.25	
F	26.54	1.045	2981	.3810E-01	.1500E-02	32.93	29.97	
F	27.69	1.090	3003	.5715E-01	.2250E-02	33.57	30.95	
F	28.70	1.130	3023	.5080E-01	.2000E-02	34.29	31.21	
F	30.35	1.195	3043	.8255E-01	.3250E-02	35.17	32.01	
F	32.00	1.260	3053	.1651E+00	.6500E-02	36.24	32.98	
F	32.77	1.290	3054	.1524E+00	.6000E-02	37.02	33.69	
F	34.80	1.370	3063	.4064E+00	.1600E-01	37.91	34.50	
F	36.70	1.445	3064	.3811E+00	.1500E-01	39.16	39.63	
F	39.62	1.560	3072	.7303E+00	.2875E-01	40.67	37.01	
F	40.39	1.590	3075	.2540E+00	.1000E-01	41.81	38.05	
F	42.16	1.660	3077	.8890E+00	.3500E-01	42.60	38.77	
F	43.10	1.700	3078	.1016E+01	.4000E-01	43.77	39.56	
F	45.47	1.790	3079	.2286E+01	.9000E-01	44.49	40.49	
F	47.50	1.870	3080	.2032E+01	.8000E-01	45.83	41.71	
F	49.40	1.945	3081	.1975E+01	.7500E-01	47.06	42.83	
F	51.56	2.018	3082	.2157E+01	.8500E-01	48.34	43.99	

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TABLE D1-14

SPECIMEN NUMBER: 63-611
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: STIFFENED
ENVIRONMENT: ARGON
TEST TEMPERATURE: 338.0 K
SPECIMEN THICKNESS: 1.64 MM (0.064 IN)
MAXIMUM STRESS: 75.2 MPA (10.9 KSI)
FREQUENCY: 200 CPS
CYCLES TO FAILURE: 94999 CYCLES
K(MAX): 3 CYCLES PRIOR TO FAILURE: 56.03 MPA SQRT(M) (50.99 KSI SQRT(IN))

CRACK LENGTH MM	IN	CYCLES	DELTA(KI)/DELTA(IN) MM/CYCLE	IN/CYCLE	DELTA(STRESS INTENSITY) MPA SQRT(IN)	MSI SQRT(IN)
7.35	.289	20001	.9372E-04	.3690E-05	11.07	10.07
7.89	.310	25733	.7102E-04	.2796E-05	11.47	10.44
8.47	.334	33977	.1154E-03	.4544E-05	11.89	10.82
9.10	.358	39380	.1061E-03	.4175E-05	12.30	11.19
9.70	.382	45080	.1536E-03	.6047E-05	12.71	11.57
10.37	.408	49421	.1391E-03	.4478E-05	13.11	11.93
10.96	.431	53656	.1958E-03	.7798E-05	13.50	12.28
11.62	.457	57029	.2136E-03	.8408E-05	13.92	12.67
12.38	.487	60591	.2440E-03	.9698E-05	14.30	13.02
12.94	.509	62806	.2227E-03	.8767E-05	14.60	13.29
13.42	.528	65036	.3407E-03	.1341E-04	14.90	13.56
14.01	.552	66788	.3019E-03	.1189E-04	15.23	13.86
14.62	.576	68807	.3894E-03	.1454E-04	15.54	14.15
15.16	.597	70268	.4492E-03	.1768E-04	15.91	14.48
16.02	.631	72168	.6017E-03	.2369E-04	16.29	14.82
16.60	.654	73141	.4284E-03	.1607E-04	16.62	15.13
17.35	.683	74881	.6284E-03	.2474E-04	16.95	15.42
17.89	.704	75742	.6118E-03	.2409E-04	17.30	15.74
18.76	.739	77166	.7355E-03	.2895E-04	17.63	16.05
19.23	.759	77874	.7659E-03	.3016E-04	18.09	16.46
20.66	.813	79679	.9276E-03	.3652E-04	18.64	17.00
21.80	.854	80902	.1103E-02	.4343E-04	19.29	17.56
23.34	.919	82303	.1317E-02	.5197E-04	19.90	18.11
24.54	.966	83214				
25.93	1.021	84295	.1284E-02	.5056E-04	20.47	18.63
27.26	1.073	85063	.1736E-02	.6836E-04	21.04	19.16
28.52	1.123	85749	.1833E-02	.7216E-04	21.61	19.67
29.90	1.177	86445	.1985E-02	.7816E-04	22.16	20.17
31.31	1.233	87112	.2113E-02	.8321E-04	22.74	20.69
32.51	1.281	87663	.2229E-02	.8777E-04	23.28	21.18
33.95	1.337	88175	.2745E-02	.1081E-03	23.81	21.67
35.30	1.390	88614	.3084E-02	.1214E-03	24.37	22.18
36.71	1.444	89093	.2918E-02	.1157E-03	24.92	22.68
37.81	1.488	89442	.3547E-02	.1396E-03	25.42	23.13
39.28	1.546	89831	.3424E-02	.1344E-03	25.93	23.60
40.67	1.601	90280	.3111E-02	.1225E-03	26.49	24.11
42.08	1.657	90637	.4295E-02	.1691E-03	27.04	24.61
43.49	1.712	90911	.4646E-02	.1829E-03	27.60	25.12
44.68	1.759	91161	.4765E-02	.1876E-03	28.11	25.58
45.85	1.805	91387	.5199E-02	.2031E-03	28.57	26.00
47.26	1.861	91666	.5080E-02	.2000E-03	29.08	26.47
48.70	1.918	91937	.5401E-02	.2355E-03	29.65	26.98
50.10	1.972	92146	.5824E-02	.2293E-03	30.21	27.49
51.29	2.019	92332	.6425E-02	.2533E-03	30.72	27.96
52.65	2.073	92524	.7071E-02	.2784E-03	31.23	28.42
54.74	2.118	92664	.7783E-02	.3064E-03	31.77	28.87
56.93	2.162	92833	.7034E-02	.2769E-03	32.14	29.29
58.26	2.215	92989	.8516E-02	.3353E-03	32.70	29.76
59.70	2.272	93140	.9562E-02	.3772E-03	33.27	30.27
60.05	2.325	93304	.8201E-02	.3229E-03	33.84	30.80
61.27	2.373	93453	.8183E-02	.3221E-03	34.38	31.29
61.44	2.419	93567	.1033E-01	.4068E-03	34.89	31.75
62.84	2.474	93685	.1182E-01	.4653E-03	35.43	32.25
64.13	2.529	93797	.1150E-01	.4527E-03	36.01	32.77
65.73	2.588	93914	.1373E-01	.5406E-03	36.64	33.35
67.18	2.645	94030	.1247E-01	.4909E-03	37.32	33.96
			.1508E-01	.5937E-03	38.00	34.58

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	68.73	2.726	94133	.1548E-01	.6093E-03	38.67	35.20
	70.14	2.761	94224	.1453E-01	.5719E-03	39.33	35.80
	71.56	2.817	94322	.1549E-01	.6099E-03	39.93	36.34
	72.66	2.861	94393	.2171E-01	.8548E-03	40.92	36.87
	74.01	2.914	94455	.2474E-01	.9740E-03	41.16	37.46
	75.30	2.964	94507	.2504E-01	.9898E-03	42.58	38.75
F	79.63	3.135	94680	.2540E-01	.1000E-02	44.05	40.09
F	80.90	3.185	94730	.3556E-01	.1400E-02	44.80	43.84
F	82.68	3.255	94783	.3332E-01	.1300E-02	45.83	41.71
F	84.33	3.320	94830	.3302E-01	.1300E-02	46.78	42.57
F	85.98	3.385	94880	.4064E-01	.1600E-02	47.88	43.57
F	88.01	3.465	94933	.3266E-01	.1286E-02	48.85	44.46
F	89.15	3.510	94965	.1026E+00	.4038E-02	50.06	45.56
F	91.82	3.615	94991	.6032E+00	.2375E-01	51.76	47.10
F	94.23	3.710	94995	.8893E+00	.3500E-01	52.91	48.15
F	95.12	3.745	94996				

TABLE D1-15

SPECIMEN NUMBER: 63-219
 ALLOY TYPE: 2024-T861
 SPECIMEN ORIENTATION: LONGITUDINAL
 CONSTRAINT: STIFFENED
 ENVIRONMENT: AIRCRAFT
 TEST TEMPERATURE: 302.0 K
 SPECIMEN THICKNESS: 1.61 MM (1.0635 IN)
 MAXIMUM STRESS: 118.7 MPA (17.2 KSI)
 R-RATIO: 0.5
 FREQUENCY: 200 CPM
 CYCLES TO FAILURE: 16328 CYCLES
 K(MAX) 1 CYCLES PRIOR TO FAILURE: 66.48 MPA SQRT(IN) (60.50 KSI SQRT(IN))

	CRACK LENGTH			DELTA(A)/DELTA(M)		DELTA(STRESS INTENSITY)	
	MM	IN	CYCLES	MM/CYCLE	IN/CYCLE	MPA SQRT(IN)	KSI SQRT(IN)
	5.62	.221	1	.3125E-03	.1230E-04	15.41	14.03
	6.21	.244	1099	.3769E-03	.1484E-04	16.24	14.78
	6.91	.272	3766	.4270E-03	.1681E-04	17.17	15.62
	7.74	.305	5708	.6669E-03	.2626E-04	18.14	16.51
	8.62	.339	7022	.8265E-03	.3254E-04	18.91	17.21
	9.14	.360	7652	.8802E-03	.3465E-04	19.73	17.96
	10.18	.401	8038	.1444E-02	.5702E-04	20.72	18.86
	11.10	.437	9472	.1414E-02	.5566E-04	21.70	19.74
	12.20	.480	10250	.1368E-02	.5388E-04	22.54	20.51
	12.91	.508	10766	.2202E-02	.8679E-04	23.24	21.15
	13.77	.542	11157	.2203E-02	.8675E-04	24.05	21.89
	14.76	.581	11636	.2640E-02	.1039E-03	25.04	22.79
	16.10	.634	12114	.2622E-02	.1032E-03	26.00	23.66
	17.11	.674	12499	.3310E-02	.1303E-03	26.80	24.39
	18.09	.712	12796	.4223E-02	.1663E-03	27.52	25.05
	18.47	.747	13035	.4209E-02	.1657E-03	28.37	25.82
	20.31	.800	13323	.5115E-02	.2014E-03	29.44	26.83
	21.96	.865	13645	.5431E-02	.2138E-03	30.74	27.98
	23.81	.937	13985	.5908E-02	.2325E-03	31.98	29.11
	25.50	1.004	14271	.7271E-02	.2863E-03	33.20	30.21
	27.35	1.077	14526	.8574E-02	.3376E-03	34.34	31.28
	29.00	1.142	14719	.8864E-02	.3498E-03	35.56	32.36
	30.95	1.218	14939	.1163E-01	.4603E-03	36.75	33.44
	32.66	1.286	15084	.1164E-01	.4541E-03	37.74	34.14
	34.02	1.339	15231	.1448E-01	.5829E-03	38.72	35.24
	35.75	1.407	15318	.1248E-01	.4914E-03	39.86	36.28
	37.65	1.442	15473	.1574E-01	.6198E-03	40.98	37.36
	39.32	1.548	15576	.2023E-01	.7966E-03	42.06	38.28
	41.10	1.618	15664	.1781E-01	.7011E-03	43.05	39.17
	42.49	1.673	15742	.2398E-01	.9419E-03	43.97	40.02
F	44.07	1.735	15868	.2721E-01	.1071E-02	45.04	41.10
F	45.07	1.810	15874	.2359E-01	.9244E-03	46.14	42.31
F	47.11	1.875	15944	.2328E-01	.9167E-03	47.12	42.98
F	49.02	1.933	16028	.3813E-01	.1500E-02	48.15	43.42
F	50.93	2.005	16058	.3813E-01	.1503E-02	49.36	44.92
F	52.83	2.090	16138				

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F	54.10	2.130	16140	.3175E-01	.1250E-02	50.37	45.84
F	55.37	2.180	16183	.3629E-01	.1429E-02	51.18	46.58
F	57.28	2.255	16208	.7621E-01	.3001E-02	52.21	47.51
F	58.67	2.310	16233	.5586E-01	.2200E-02	53.29	48.49
F	60.58	2.385	16253	.9525E-01	.3750E-02	54.38	49.49
F	61.85	2.435	16268	.8467E-01	.3333E-02	55.44	50.49
F	63.12	2.485	16283	.8467E-01	.3333E-02	56.30	51.23
F	64.64	2.545	16293	.1524E+00	.6000E-02	57.25	52.10
F	66.80	2.630	16305	.1799E+00	.7083E-02	58.54	53.27
F	68.45	2.695	16314	.1834E+00	.7222E-02	59.89	54.50
F	69.98	2.755	16321	.2177E+00	.8571E-02	61.03	55.54
F	72.26	2.845	16327	.3813E+00	.1500E-01	62.44	56.82

TABLE D1-16

SPECIMEN NUMBER: 63-462
 ALLOY TYPE: 2124-T861
 SPECIMEN ORIENTATION: LONGITUDINAL
 CONSTRAINT: STIFFENED
 ENVIRONMENT: ARGON
 TEST TEMPERATURE: 337 K
 SPECIMEN THICKNESS: 1.52 MM (1.0600 IN)
 MAXIMUM STRESS: 244.4 MPA (35.4 KSI)
 R-RATIO: 0.3
 FREQUENCY: 200 CPM
 CYCLES TO FAILURE: 1637 CYCLES
 K(MAX) 214 CYCLES PRIOR TO FAILURE 48.15 MPA SQRT(M) (43.77 KSI SQRT(IN))

CRACK LENGTH MM	IN	CYCLES	DELTA (A)/DELTA (M) MM/CYCLE	IN/CYCLE	DELTA STRESS INTENSITY MPA SQRT(M)	KSI SQRT(IN)
3.62	.143	1	.1931E-02	.7803E-04	25.94	23.61
4.33	.170	366	.3298E-02	.1298E-03	28.00	25.48
4.93	.194	549	.4624E-02	.1821E-03	30.03	27.33
5.72	.225	719	.3401E-02	.1339E-03	31.80	28.94
6.21	.245	869	.6094E-02	.2399E-03	33.36	31.36
6.91	.272	979	.6604E-02	.2600E-03	35.09	31.93
7.60	.299	1084	.1115E-01	.4349E-03	36.61	33.32
8.19	.322	1137	.9917E-02	.3904E-03	38.29	34.84
9.67	.387	1226	.9862E-02	.3883E-03	39.45	36.35
9.70	.382	1293	.1527E-01	.6010E-03	41.42	37.69
10.46	.412	1340	.1537E-01	.5933E-03	43.00	39.13
11.28	.443	1392	.3191E-01	.1296E-02	44.75	41.72
12.24	.482	1423				

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TABLE D1-17

SPECIMEN NUMBER: 63-576
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINT: STIFFENED
ENVIRONMENT: ARGON
TEST TEMPERATURE: 303.2 K
SPECIMEN THICKNESS: 1.65 MM (0.0650 IN)
MAXIMUM STRESS: 74.5 MPA (10.8 KSI)
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 65606 CYCLES
K(MAX) 51 CYCLES PRIOR TO FAILURE: 41.03 MPA SQRT(M) (37.34 KSI SQRT(IN))

CRACK LENGTH MM IN	MM IN	CYCLES I	DELTA (A)/DELTA (W) MM/CYCLE IN/CYCLE	DELTA (STRESS INTENSITY) MPA SQRT(M) KSI SQRT(IN)	DELTA (STRESS INTENSITY) MPA SQRT(M) KSI SQRT(IN)
7.49	.295		.7077E-04	.2786E-05	11.10
8.12	.320	8956	.1150E-03	.4529E-05	11.70
9.19	.362	10274	.1050E-03	.4136E-05	11.29
10.26	.404	28454	.2966E-03	.1168E-04	12.92
10.81	.426	30308	.1506E-03	.5930E-05	13.27
11.40	.449	34229	.2243E-03	.8832E-05	13.63
12.04	.474	37049	.3029E-03	.1192E-04	14.04
12.79	.503	39519	.2162E-03	.8511E-05	14.45
13.50	.531	42797	.3370E-03	.1327E-04	14.87
14.32	.564	45284	.3815E-03	.1502E-04	15.33
15.17	.597	47468	.4078E-03	.1606E-04	15.71
15.77	.621	48944	.4823E-03	.1899E-04	16.03
16.43	.647	50316	.5281E-03	.2079E-04	16.40
17.21	.677	51783	.5712E-03	.2249E-04	16.82
18.11	.713	53366	.7931E-03	.3122E-04	17.21
18.83	.741	54274	.8065E-03	.3175E-04	17.76
19.41	.804	56233	.1092E-02	.4300E-04	18.43
21.71	.855	57426	.1114E-02	.4385E-04	19.03
23.05	.917	58622	.1564E-02	.6196E-04	19.66
24.54	.966	59578	.1727E-02	.6801E-04	20.30
26.03	1.024	60422	.1880E-02	.7402E-04	20.92
27.44	1.080	61190	.2192E-02	.8629E-04	21.56
29.05	1.144	61923	.2777E-02	.1093E-03	22.18
30.43	1.198	62422			
32.02	1.261	62985	.3279E-02	.1291E-03	22.79
33.63	1.324	63341	.3688E-02	.1452E-03	23.43
35.33	1.391	63699	.4754E-02	.1872E-03	24.09
36.74	1.447	64076	.3759E-02	.1480E-03	24.71
38.23	1.507	64314	.6473E-02	.2548E-03	25.29
39.84	1.568	64584	.5743E-02	.2261E-03	25.90
41.43	1.630	64813	.6929E-02	.2728E-03	26.51
42.74	1.693	65007	.6814E-02	.2683E-03	27.07
44.14	1.738	65189	.7711E-02	.3036E-03	27.61
45.34	1.735	65311	.9757E-02	.3441E-03	28.11
46.41	1.843	65486	.8375E-02	.3297E-03	28.63
47.15	1.896	65601	.1171E-01	.4609E-03	29.18
48.71	1.957	65765	.9479E-02	.3732E-03	29.75
50.45	2.036	65864	.1253E-01	.4914E-03	30.33
51.09	2.090	66003	.1539E-01	.6058E-03	30.97
52.49	2.145	66068	.2363E-01	.8515E-03	31.64
53.31	2.218	66151	.2209E-01	.8499E-03	32.31
54.47	2.263	66211	.1909E-01	.7517E-03	32.94
55.16	2.123	66274	.2484E-01	.9779E-03	33.52
56.50	2.182	66334	.2434E-01	.9582E-03	34.14
57.05	2.441	66376	.3696E-01	.1451E-02	34.75
58.36	2.494	66414	.3448E-01	.1157E-02	35.36
59.74	2.590	66463	.4954E-01	.1951E-02	36.16
60.21	2.646	66484	.6779E-01	.2449E-02	37.01
61.89	2.712	66520	.4667E-01	.1837E-02	37.70
63.77	2.747	66535	.5884E-01	.2337E-02	38.28
65.29	2.767	66545	.5194E-01	.2045E-02	38.66
67.84	2.749	66555	.5512E-01	.2170E-02	38.85

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TABLE D1-18

SPECIMEN NUMBER: 63-872
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINT: STIFFENED
ENVIRONMENT: ARGON
TEST TEMPERATURE: 302.6 K
SPECIMEN THICKNESS: 1.63 MM (0.0643 IN)
MAXIMUM STRESS: 116.6 MPa (17.2 KSI)
Q-RATIO: 1.35
FREQUENCY: 260 CPM
CYCLES TO FAILURE: 10236 CYCLES
K(MAX) 296 CYCLES PRIOR TO FAILURE: 36.96 MPa SQRT(IN) (33.64 KSI SQRT(IN))

CRACK LENGTH MM	IN	CYCLES	DELTA (A)/DELTA (IN) MM/CYCLE	IN/CYCLE	DELTA (STRESS MPa SQRT(IN)	INTENSITY) KSI SQRT(IN)
5.60	.221	1	.5078E-03	.1999E-04	15.46	14.05
6.33	.249	1429	.5008E-03	.2318E-04	16.33	14.86
7.03	.277	2611	.7304E-03	.2875E-04	17.49	15.92
8.28	.326	4329	.8318E-03	.3275E-04	18.70	17.02
9.20	.362	5434	.1003E-02	.3950E-04	19.71	17.93
10.19	.401	6420	.1609E-02	.6338E-04	20.80	18.93
11.39	.448	7165	.2579E-02	.1019E-03	21.85	19.89
12.39	.488	7554	.2430E-02	.9567E-04	22.85	20.61
13.12	.517	7854	.2800E-02	.1102E-03	23.24	21.15
13.72	.540	8069	.3875E-02	.1526E-03	23.90	21.75
14.63	.576	8303	.3394E-02	.1336E-03	24.70	22.40
15.60	.614	8590	.5949E-02	.2342E-03	25.61	23.30
16.03	.663	8796	.4331E-02	.1706E-03	26.47	24.09
17.76	.699	9012	.7524E-02	.2962E-03	27.23	24.78
18.76	.738	9144	.8935E-02	.3518E-03	27.99	25.47
19.77	.778	9257	.9744E-02	.3836E-03	29.00	26.39
21.46	.845	9431	.9907E-02	.3901E-03	30.27	27.55
23.25	.916	9612	.1636E-01	.6440E-03	31.43	28.61
24.76	.975	9704	.1743E-01	.6861E-03	32.43	29.51
26.14	1.029	9783	.1935E-01	.7617E-03	33.49	30.47
27.88	1.098	9873	.2368E-01	.9321E-03	34.59	31.48
29.46	1.160	9940				

TABLE D1-19

SPECIMEN NUMBER: 63-678
ALLOY TYPE: 2124-T851
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINT: STIFFENED
ENVIRONMENT: ARGON
TEST TEMPERATURE: 334.3 K
SPECIMEN THICKNESS: 1.65 MM (0.0650 IN)
MAXIMUM STRESS: 193.7 MPa (28.0 KSI)
Q-RATIO: 1.35
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 1246 CYCLES
K(MAX) 60 CYCLES PRIOR TO FAILURE: 37.79 MPa SQRT(IN) (34.19 KSI SQRT(IN))

CRACK LENGTH MM	IN	CYCLES	DELTA (A)/DELTA (IN) MM/CYCLE	IN/CYCLE	DELTA (STRESS MPa SQRT(IN)	INTENSITY) KSI SQRT(IN)
3.89	.145	1	.2035E-02	.7893E-04	21.03	19.14
4.21	.166	262	.3395E-02	.1337E-03	22.37	20.36
4.73	.186	415	.4132E-02	.1627E-03	23.72	21.59
5.31	.209	557	.4614E-02	.1895E-03	24.98	22.74
5.82	.229	662	.4474E-02	.1761E-03	26.29	23.92
6.53	.256	815	.9419E-02	.3700E-03	27.71	25.22
7.19	.283	887	.7562E-02	.2977E-03	28.84	26.29
7.84	.302	951	.7458E-02	.3724E-03	30.05	27.35
8.40	.331	1029	.1246E-01	.4705E-03	31.30	28.56
9.12	.359	1087	.1867E-01	.7273E-03	32.96	29.67
9.73	.383	1123	.2438E-01	.9600E-03	33.97	30.87
10.71	.422	1162	.2906E-01	.1144E-02	35.32	32.14
11.44	.449	1185				

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TABLE D1-20

SPECIMEN NUMBER: 63-216
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: STIFFENED
ENVIRONMENT: ARGON
TEST TEMPERATURE: 80.3 K
SPECIMEN THICKNESS: 1.64 MM (0.0645 IN)
MAXIMUM STRESS: 75.2 MPA (10.9 KSI)
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 269781 CYCLES
K(MAX) 161 CYCLES PRIOR TO FAILURE: 61.41 MPA SQR(T IN) (55.89 KSI SQR(T IN))

CRACK LENGTH MM IN	THICKNESS MM IN	CYCLES	DELTA(K)/DELTA(N) MM/CYCLE IN/CYCLE	DELTA(Stress Intensity) MPa SQR(T IN) KSI SQR(T IN)
9.34	.360	1	.2453E-04	.9657E-06
10.01	.394	26975	.3700E-04	.1457E-05
10.64	.419	44135	.2717E-04	.1070E-05
11.14	.436	62317	.4019E-04	.1591E-05
12.17	.479	88133	.4819E-04	.1897E-05
13.12	.512	105654	.5542E-04	.2142E-05
13.69	.539	117799	.5555E-04	.2187E-05
14.30	.563	128796	.5746E-04	.2282E-05
15.05	.592	141879	.7347E-04	.2892E-05
15.58	.614	148974	.7671E-04	.3221E-05
16.29	.642	158243	.8099E-04	.3189E-05
16.99	.669	166883	.1008E-03	.3469E-05
17.55	.691	172439	.9573E-04	.3768E-05
18.18	.716	179021	.8594E-04	.3384E-05
18.76	.739	185730	.1317E-03	.5185E-05
19.65	.775	192493	.1206E-03	.4746E-05
21.12	.812	204692	.1827E-03	.7192E-05
22.61	.890	212847	.2224E-03	.8755E-05
23.87	.940	218495	.2811E-03	.1107E-04
25.81	1.116	225388	.2798E-03	.1098E-04
26.82	1.096	229029	.3822E-03	.1575E-04
28.49	1.122	233385	.4023E-03	.1581E-04
29.78	1.172	236595	.5111E-03	.2012E-04
31.25	1.230	239475	.5592E-03	.2292E-04
32.90	1.295	242432	.7330E-03	.2886E-04
34.26	1.349	244279	.7214E-03	.2840E-04
35.83	1.411	246455	.6405E-03	.2521E-04
37.24	1.466	248666	.9099E-03	.3582E-04
38.49	1.515	250038	.8894E-03	.3502E-04
40.01	1.575	251700	.1134E-02	.4499E-04
41.32	1.627	252897	.1174E-02	.4622E-04
42.99	1.692	254312	.1256E-02	.4945E-04
44.24	1.742	255308	.1392E-02	.5482E-04
45.52	1.792	256232	.1357E-02	.5341E-04
46.76	1.841	257142	.1564E-02	.6164E-04
48.29	1.897	258062	.1531E-02	.5911E-04
49.60	1.953	258999	.1815E-02	.7146E-04
50.95	2.006	259743	.2215E-02	.9721E-04
52.13	2.051	260252	.2103E-02	.8278E-04
53.46	2.104	260896	.2094E-02	.8251E-04
54.69	2.153	261494	.2583E-02	.1017E-03
55.92	2.201	261968	.2307E-02	.9081E-04
57.47	2.263	262641	.2540E-02	.1000E-03
58.85	2.317	263183	.2809E-02	.1104E-03
60.25	2.372	263684	.3118E-02	.1228E-03
61.51	2.421	264086	.3813E-02	.1500E-03
62.41	2.458	264328	.3998E-02	.1578E-03
63.84	2.513	264680	.4182E-02	.1639E-03
65.23	2.568	265016	.4899E-02	.1929E-03
67.19	2.645	265415	.4300E-02	.1691E-03
68.71	2.705	265772	.4694E-02	.1848E-03
70.46	2.774	266142	.5219E-02	.2059E-03
72.08	2.838	266453	.4787E-02	.1889E-03
73.78	2.905	266808	.6134E-02	.2419E-03
75.19	2.960	267037	.1193E-01	.4698E-03
77.60	3.055	267239	.9169E-02	.2035E-03

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41.19	3.195	267927	.8467E-02	.3333E-03	24.04	21.88
45.34	3.363	268422	.1012E-01	.3982E-03	25.03	22.78
47.63	3.450	268648	.1129E-01	.4444E-03	25.72	23.41
49.66	3.530	268828	.1192E-01	.4694E-03	26.56	24.17
42.58	3.645	269073	.1531E-01	.6027E-03	27.70	25.21
46.01	3.780	269297	.1972E-01	.7764E-03	28.97	26.37
49.19	3.905	269458	.1490E-01	.5864E-03	30.14	27.43
101.60	4.800	269620				

TABLE D1-21

SPECIMEN NUMBER: 63-1113
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: STIFFENED
ENVIRONMENT: ARGON
TEST TEMPERATURE: 302.6 K
SPECIMEN THICKNESS: 1.54 MM (.0645 IN)
MAXIMUM STRESS: 118.7 MPA (17.2 KSI)
R-RATIO: 50
FREQUENCY: 230 CPM
CYCLES TO FAILURE: 417758 CYCLES

CRACK LENGTH MM	IN	CYCLES	DELTA(A)/DELTA(N) MM/CYCLE	IN/CYCLE	DELTA(Stress MPA Sqrt(N))	Intensity KSI Sqrt(N)
7.92	.288					
7.92	.312	4309	.1397E-03	.5501E-05	9.20	8.37
4.47	.134	8605	.1277E-03	.5028E-05	9.54	8.68
9.91	.351	11760	.1401E-03	.5515E-05	9.82	8.94
9.77	.384	16044	.1986E-03	.7820E-05	10.19	9.27
11.35	.405	17845	.2995E-03	.1143E-04	10.56	9.61
11.13	.438	19938	.3968E-03	.1562E-04	10.92	9.94
11.76	.463	21415	.4248E-03	.1672E-04	11.29	1.127
12.45	.490	22731	.5422E-03	.2115E-04	11.62	10.57
13.52	.532	24429	.6152E-03	.2422E-04	12.04	11.96
14.51	.571	25916	.6670E-03	.2626E-04	12.52	11.39
15.43	.608	26930	.9116E-03	.3593E-04	12.95	11.78
16.20	.638	27640	.1016E-02	.4007E-04	13.32	12.12
16.95	.667	28331	.1157E-02	.4555E-04	13.64	12.41
17.77	.703	29132	.1005E-02	.3959E-04	13.97	12.72
18.38	.724	29595	.1362E-02	.5361E-04	14.27	12.98
18.15	.754	30171	.1341E-02	.5278E-04	14.54	11.24
21.14	.805	31063	.1444E-02	.5684E-04	14.96	11.61
21.86	.861	31874	.1752E-02	.6899E-04	15.48	14.09
23.55	.927	32771	.1887E-02	.7432E-04	16.08	14.63
24.27	.995	33435	.2592E-02	.1020E-03	16.71	15.20
26.62	1.068	33995	.2399E-02	.9446E-04	17.26	15.71
29.13	1.107	34438	.3417E-02	.1349E-03	17.77	16.17
29.24	1.151	34730	.3813E-02	.1503E-03	18.23	16.59
31.78	1.212	35046	.4199E-02	.1653E-03	18.69	17.10
31.96	1.258	35398	.4035E-02	.1588E-03	19.15	17.43
33.37	1.114	35725	.4197E-02	.1652E-03	19.59	17.83
34.85	1.172	35961	.6264E-02	.2468E-03	20.07	18.27
36.86	1.451	36251	.6889E-02	.2712E-03	20.65	14.40
38.36	1.510	36492	.6273E-02	.2469E-03	21.23	17.32
40.29	1.486	36717	.8582E-02	.3374E-03	21.80	19.84
41.51	1.634	36856	.8780E-02	.3457E-03	22.31	21.12
43.57	1.716	37063	.1044E-01	.4127E-03	22.85	23.79
44.84	1.765	37134	.1491E-01	.5471E-03	23.39	21.29
46.46	1.849	37316	.1193E-01	.4645E-03	23.95	21.79
48.49	1.909	37388	.2124E-01	.8364E-03	24.54	22.34
51.14	2.013	37475	.3064E-01	.1198E-02	25.23	22.96
52.13	2.052	37497	.4509E-01	.1775E-02	25.83	23.51
58.61	2.244	37461	.8902E-01	.3525E-02	26.99	24.56
42.10	2.162	37578	.1333E-03	.4247E-02	28.33	25.79

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TABLE D1-22

SPECIMEN NUMBER: 63-2110				2024-T861		
ALLOY TYPE: 2024-T861				LONGITUDINAL		
SPECIMEN ORIENTATION: LONGITUDINAL				STIFFENED		
CONSTRAINT: STIFFENED				ARCON		
ENVIRONMENT: ARCON				304.3 K		
TEST TEMPERATURE: 304.3 K				1.53 MM (1.564 IN)		
SPECIMEN THICKNESS: 1.53 MM (1.564 IN)				229.5 MPA (32.7 KSI)		
MAXIMUM STRESS: 229.5 MPA (32.7 KSI)				250		
R-RATIO: 250				200 CPM		
FREQUENCY: 200 CPM				3655 CYCLES		
CYCLES TO FAILURE: 3655 CYCLES				67.80 MPA SQR(T(M)) (61.70 KSI SQR(T(IN))		
K(IMAX) 15 CYCLES PRIOR TO FAILURE						
CRACK LENGTH		CYCLES	DELTA(A)/DELTA(N)		DELTA(Stress Intensity)	
MM	IN		MM/CYCLE	IN/CYCLE	MPA SQR(T(M))	KSI SQR(T(IN))
5.29	.208	1	.9038E-03	.3558E-04	14.95	13.60
5.89	.232	660	.1429E-02	.5628E-04	15.80	14.38
6.59	.259	1154	.2236E-02	.8804E-04	16.90	15.38
7.66	.302	1639	.2836E-02	.1117E-03	18.12	16.49
8.72	.343	2089	.4017E-02	.1581E-03	19.17	17.45
9.61	.378	2229	.4399E-02	.1732E-03	19.98	18.18
10.27	.404	2380	.4703E-02	.1852E-03	20.59	18.73
10.83	.426	2498	.5337E-02	.2101E-03	21.09	19.19
11.30	.445	2587	.6469E-02	.2547E-03	21.68	19.73
12.06	.475	2704	.6340E-02	.2496E-03	22.40	20.39
12.87	.507	2831	.9407E-02	.3704E-03	22.99	20.93
13.37	.527	2885	.9306E-02	.3664E-03	23.46	21.35
13.91	.548	2943	.1150E-01	.4526E-03	24.08	21.92
14.61	.583	3021	.1044E-01	.4110E-03	24.84	22.61
15.71	.618	3187	.9954E-02	.3919E-03	25.52	23.22
16.45	.647	3181	.1420E-01	.5590E-03	26.10	23.75
17.16	.675	3231	.1420E-01	.5591E-03	26.66	24.26
17.85	.703	3283	.1958E-01	.7750E-03	27.21	24.76
18.56	.731	3316	.1720E-01	.6770E-03	28.14	25.61
20.28	.798	3416	.1945E-01	.7658E-03	29.33	26.69
21.76	.857	3492	.3172E-01	.1249E-02	30.40	27.67
23.25	.915	3539	.2847E-01	.1121E-02	31.51	28.67
24.90	.980	3597	.4883E-01	.1922E-02	32.57	29.64
26.32	1.036	3626	.9017E-01	.3590E-02	33.47	30.46
27.58	1.086	3648				

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TABLE D1-23

SPECIMEN NUMBER:
ALLOY TYPE:
SPECIMEN ORIENTATION:
CONSTRAINT:
ENVIRONMENT:
TEST TEMPERATURE:
SPECIMEN THICKNESS:
MAXIMUM STRESS:
R-RATIO:
FREQUENCY:
CYCLES TO FAILURE:

63-377
2024-T861
SPECIMEN NO.
38847
1.63 MM (0.064 IN)
74.4 MPa (10.8 KSI)
280 CPM
106470 CYCLES

CRACK LENGTH		CYCLES	DELTA (A1)/DELTA (A2)		DELTA (STRESS INTENSITY)	
MM	IN		MM/CYCLE	IN/CYCLE	MPa SQRT (N)	KSI SQRT (IN)
10.94	.431		.3944E-04	.1553E-05	7.01	6.38
11.52	.453	14683	.2856E-04	.1124E-05	7.19	6.54
12.08	.475	34340	.5406E-04	.2120E-05	7.37	6.71
12.67	.499	45334	.4758E-04	.1873E-05	7.56	6.88
13.37	.526	99981	.6922E-04	.2725E-05	7.73	7.04
13.84	.545	66823	.7839E-04	.3086E-05	7.88	7.17
14.39	.566	73741	.7938E-04	.3125E-05	8.07	7.34
15.29	.598	83965	.8388E-04	.3303E-05	8.31	7.56
16.13	.635	95108	.9624E-04	.3789E-05	8.52	7.76
16.78	.661	101851	.8163E-04	.3214E-05	8.78	7.91
17.42	.686	109692	.1880E-03	.7400E-05	8.86	8.06
18.02	.709	112881	.1434E-03	.5647E-05	9.02	8.21
18.67	.735	117414	.1778E-03	.7999E-05	9.20	8.37
19.43	.765	121672	.1907E-03	.7508E-05	9.45	8.60
20.76	.817	128445	.2587E-03	.1019E-04	9.80	8.92
22.29	.878	134985	.3325E-03	.1309E-04	10.12	9.21
23.46	.924	138867	.4051E-03	.1595E-04	10.44	9.50
25.03	.985	141978	.4697E-03	.1849E-04	10.81	9.84
26.72	1.052	145569	.4909E-03	.1933E-04	11.13	10.12
27.35	1.096	147869	.7829E-03	.3082E-04	11.48	10.45
29.97	1.180	150573	.8433E-03	.3320E-04	11.87	10.88
31.45	1.238	152335	.8495E-03	.3344E-04	12.19	11.10
33.10	1.299	154159	.1180E-02	.4647E-04	12.52	11.40
34.51	1.361	155493	.1586E-02	.6246E-04	12.84	11.68
36.02	1.418	156401	.1327E-02	.5224E-04	13.13	11.95
37.41	1.473	157449	.1543E-02	.6073E-04	13.44	12.23
39.61	1.536	158484	.1857E-02	.7312E-04	13.78	12.54
40.71	1.603	159405	.2335E-02	.9194E-04	14.13	12.86
42.34	1.668	160118	.2251E-02	.8863E-04	14.49	13.19
44.28	1.743	160962	.2327E-02	.9180E-04	14.84	13.51
45.82	1.804	161623	.3392E-02	.1330E-03	15.15	13.79
47.38	1.862	162061	.4327E-02	.1703E-03	15.56	14.16
49.74	1.958	162624	.3917E-02	.1542E-03	15.96	14.53
51.22	2.017	163003	.5525E-02	.2175E-03	16.26	14.80
52.61	2.071	163254	.3902E-02	.1536E-03	16.57	15.08
54.17	2.133	163854	.3256E-02	.1242E-03	16.87	15.35
55.43	2.182	164039	.7963E-02	.3135E-03	17.15	15.61
56.81	2.237	164213	.4440E-02	.1764E-03	17.45	15.88
58.20	2.291	164522	.5627E-02	.2215E-03	17.80	16.19
60.02	2.363	164847	.8097E-02	.3188E-03	18.19	16.56
61.81	2.434	165084	.1316E-01	.5179E-03	18.55	16.88
63.21	2.488	165174	.6962E-02	.2741E-03	18.88	17.18
64.75	2.549	165396	.1113E-01	.4382E-03	19.21	17.48
66.12	2.601	165519	.9887E-02	.3893E-03	19.53	17.77
67.46	2.656	165654	.1392E-01	.5480E-03	19.88	18.09
69.16	2.723	165776	.1348E-01	.5396E-03	20.25	18.42
70.48	2.775	165874				

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TABLE D1-24

SPECIMEN NUMBER: 63-471 ALLOY TYPE: 2024-T861 SPECIMEN ORIENTATION: TRANSVERSE CONSTRAINT: STIFFENED ENVIRONMENT: 3030 K TEST TEMPERATURE: 3030 K SPECIMEN THICKNESS: 1.68 MM (1.060 IN) MAXIMUM STRESS: 118.4 MPA (17.2 KSI) R-RATIO: 0 FREQUENCY: 200 CPS CYCLES TO FAILURE: 2088 CYCLES K(MAX): 116 CYCLES PRIOR TO FAILURE: 42.75 HPA SQRT(IN) (38.91 KSI SQRT(IN))						
CRACK LENGTH MM	CRACK LENGTH IN	CYCLES	DELTA(A)/DELTA(IN) MM/CYCLE	DELTA(A)/DELTA(IN) IN/CYCLE	DELTA(Stress Intensity) MPA SQRT(IN)	DELTA(Stress Intensity) KSI SQRT(IN)
7.90	.311	1	.1916E-03	.7543E-05	9.69	8.82
9.05	.356	9967	.2423E-03	.9539E-05	10.25	9.33
9.90	.398	9484	.3989E-03	.1571E-04	10.72	9.76
10.40	.425	11738	.6780E-03	.2638E-04	11.43	10.48
12.67	.499	14530	.8314E-03	.3273E-04	12.13	11.04
13.73	.540	15834	.9849E-03	.3877E-04	12.68	11.44
14.68	.578	18779	.1426E-02	.5615E-04	12.93	11.77
15.23	.608	17157	.1725E-02	.6798E-04	13.25	12.06
16.13	.635	17602	.9568E-03	.3767E-04	13.94	12.32
16.55	.652	18120	.2283E-02	.8990E-04	13.81	12.97
17.43	.686	14506	.1827E-02	.7192E-04	14.15	12.88
18.18	.716	18912	.2273E-02	.8949E-04	14.45	13.15
18.89	.744	19226	.2671E-02	.1052E-03	14.89	13.55
20.42	.804	19797	.2988E-02	.1161E-03	15.54	14.14
22.22	.875	28418	.3167E-02	.1247E-03	16.13	14.68
23.51	.926	28817	.3298E-02	.1298E-03	16.65	15.18
25.04	.986	21281	.5470E-02	.2158E-03	17.21	15.66
26.62	1.048	21978	.6888E-02	.2711E-03	17.77	16.17
28.17	1.109	21795	.8386E-02	.3298E-03	18.27	16.82
29.49	1.161	21952	.6648E-02	.2617E-03	18.78	17.09
31.13	1.225	22193	.9164E-02	.3688E-03	19.41	17.66
33.21	1.307	22428	.1648E-01	.6456E-03	20.28	18.38
35.82	1.418	22585	.2119E-01	.8341E-03	21.00	19.11
38.68	1.499	22692				

TABLE D1-25

SPECIMEN NUMBER: 62-311 ALLOY TYPE: 2124-T851 SPECIMEN ORIENTATION: TRANSVERSE CONSTRAINT: STIFFENED ENVIRONMENT: 3030 K TEST TEMPERATURE: 3030 K SPECIMEN THICKNESS: 1.53 MM (1.000 IN) MAXIMUM STRESS: 198.8 MPA (28.8 KSI) R-RATIO: 0 FREQUENCY: 200 CPS CYCLES TO FAILURE: 1893 CYCLES K(MAX): 11 CYCLES PRIOR TO FAILURE: 45.86 HPA SQRT(IN) (41.73 KSI SQRT(IN))						
CRACK LENGTH MM	CRACK LENGTH IN	CYCLES	DELTA(A)/DELTA(IN) MM/CYCLE	DELTA(A)/DELTA(IN) IN/CYCLE	DELTA(Stress Intensity) MPA SQRT(IN)	DELTA(Stress Intensity) KSI SQRT(IN)
5.29	.208	1	.1453E-02	.5722E-04	13.35	12.15
6.21	.244	631	.2529E-02	.9998E-04	14.37	13.08
7.11	.280	989	.6384E-02	.1726E-03	15.16	13.88
7.73	.303	1123	.9254E-02	.2668E-03	15.83	14.41
8.43	.332	1262	.4283E-02	.1688E-03	16.61	15.11
9.31	.366	1466	.6016E-02	.2369E-03	17.34	15.78
10.02	.394	1584	.1084E-01	.4266E-03	18.18	16.47
11.01	.434	1676	.1287E-01	.5065E-03	19.07	17.35
12.38	.484	1774	.1773E-01	.6982E-03	19.99	18.19
13.27	.523	1871	.5246E-01	.2066E-02	20.96	19.07
14.80	.583	1880	.9144E-01	.3688E-02	22.24	20.24
16.72	.658	1881				

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TABLE D1-26

SPECIMEN NUMBER: U63-21E
 ALLOY TYPE: 2024-T861
 SPECIMEN ORIENTATION: LONGITUDINAL
 CONSTRAINT: UNSTIFFENED
 ENVIRONMENT: AIR
 TEST TEMPERATURE: 318.5 K
 SPECIMEN THICKNESS: 1.063 IN
 MAXIMUM STRESS: 75.2 MPA 10.9 KSI
 FREQUENCY: 200 Hz
 CYCLES TO FAILURE: 89365
 K(MAX): 125 CYCLES TO FAILURE 40.57 MPA SORT(M) 16.92 KSI SORT(M)

CRACK LENGTH IN	IN	CYCLES	DELTA(K)/DELTA(N) MM/CYCLE	IN/CYCLE	DELTA STRESS INTENSITY MPA SQRT(IN)	KSI SQRT(IN)
5.99	.675	1	.716E-04	.2742E-04	11.15	10.06
6.20	.723	17140	.771E-04	.3035E-05	11.74	10.70
6.39	.753	37214	.1224E-03	.4825E-05	12.22	11.12
6.57	.777	22041	.1146E-03	.4517E-05	12.65	11.51
6.79	.815	38345	.1467E-03	.5774E-05	13.17	11.90
6.91	.829	42536	.1441E-03	.7249E-05	13.52	12.36
6.94	.852	47147	.1717E-03	.6799E-05	13.94	12.69
7.11	.886	52524	.2313E-03	.9154E-05	14.33	13.04
7.15	.914	53839	.2481E-03	.9573E-05	14.78	13.37
7.16	.937	56129	.2811E-03	.1117E-04	15.07	13.72
7.42	.968	58842	.2657E-03	.1146E-04	15.45	14.06
7.52	.991	61036	.3345E-03	.1317E-04	15.75	14.34
7.54	.913	62719	.2925E-03	.1192E-04	16.07	14.59
7.67	.933	64441	.5320E-03	.2291E-04	16.32	14.86
7.72	.958	65832	.4412E-03	.1733E-04	16.61	15.12
7.72	.977	66563	.5750E-03	.2267E-04	16.90	15.38
7.74	.713	67711	.6747E-03	.1869E-04	17.23	15.68
7.77	.731	69231	.7133E-03	.2245E-04	17.59	16.01
7.77	.751	70617	.7334E-03	.2884E-04	18.37	16.45
7.77	.766	72237	.7959E-03	.3152E-04	18.76	17.37
7.77	.777	74441	.9763E-03	.3844E-04	19.49	17.73
7.77	.935	75561	.1216E-02	.4749E-04	20.13	18.32
7.77	.941	77119	.1211E-02	.4765E-04	20.78	18.91
7.77	1.052	78422	.1492E-02	.5876E-04	21.44	19.51
7.77	1.112	79444	.1397E-02	.6286E-04	22.37	20.14
7.77	1.142	81717	.1927E-02	.7593E-04	22.65	20.57
7.77	1.221	81717	.1161E-02	.7322E-04	23.17	21.08
7.77	1.271	83446	.2440E-02	.1100E-03	23.72	21.59
7.77	1.328	82258	.2646E-02	.1129E-03	24.23	22.05
7.77	1.371	82632	.2754E-02	.1065E-03	24.75	22.52
7.77	1.410	83244	.2503E-02	.9854E-04	25.27	23.00
7.77	1.474	83449	.3241E-02	.1284E-03	25.91	23.49
7.77	1.537	84179	.7361E-02	.1402E-03	26.37	23.99
7.77	1.595	84521	.7931E-02	.1504E-03	26.87	24.46
7.77	1.639	84847	.4154E-02	.1636E-03	27.36	24.90
7.77	1.693	85140	.5385E-02	.1727E-03	27.92	25.41
7.77	1.751	85524	.4757E-02	.1873E-03	28.52	25.95
7.77	1.804	85811	.5212E-02	.2052E-03	29.11	26.49
7.77	1.867	86121	.5975E-02	.2351E-03	29.63	26.96
7.77	1.928	86294	.5188E-02	.2062E-03	30.10	27.39
7.77	1.951	86531	.7434E-02	.2927E-03	30.61	27.95
7.77	2.018	86717	.7285E-02	.2851E-03	31.23	28.42
7.77	2.043	86979	.7215E-02	.2841E-03	31.92	28.95
7.77	2.123	87119	.7694E-02	.3071E-03	32.50	29.58
7.77	2.217	87427	.1101E-01	.3904E-03	33.53	30.51
7.77	2.314	87647	.1257E-01	.4464E-03	34.27	31.19
7.77	2.337	87744	.1551E-01	.6135E-03	34.93	31.78
7.77	2.442	87942	.1621E-01	.6382E-03	35.66	32.44
7.77	2.494	87979	.1911E-01	.7727E-03	36.41	33.15
7.77	2.544	88149	.2292E-01	.9021E-03	37.17	33.83
7.77	2.622	88142	.2594E-01	.1021E-02	37.96	34.55
7.77	2.722	88243				

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2024-T861 AND 2124-T851

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TABLE D1-27

SPECIMEN NUMBER: U63-2L2
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
ENVIRONMENT: ARGON
TEST TEMPERATURE: 332.8 K
SPECIMEN THICKNESS: 1.65 MM (0.065 IN)
MAXIMUM STRESS: 118.6 MPA (17.2 KSI)
R-RATIO: .35
FREQUENCY: 200 GPM
CYCLES TO FAILURE: 1654 CYCLES
K(MAY) 102 CYCLES PRIOR TO FAILURE: 43.64 MPA SORT(M) (39.72 KSI SORT(IN))

CRACK LENGTH MM	IN	CYCLES	DELTA(S)/DELTA(M) MM/CYCLE	IN/CYCLE	DELTA(Stress) MPA SORT(M)	INTENSITY KSI SORT(IN)
5.41	.713	1	.2105E-03	.8286E-05	15.02	13.67
5.63	.737	2323	.2982E-03	.1127E-04	15.74	14.34
5.64	.758	4573	.4693E-03	.1846E-04	16.48	14.90
7.06	.278	1675	.5017E-03	.1943E-04	17.27	15.72
7.47	.710	7276	.6494E-03	.2554E-04	18.11	16.48
4.54	.338	83.6	.9543E-03	.3364E-04	18.94	17.24
3.23	.170	3293	.1095E-02	.4310E-04	19.78	18.06
10.14	.399	9987	.1222E-02	.4811E-04	20.53	18.68
10.09	.424	11594	.1134E-02	.4345E-04	21.21	19.32
11.53	.454	11194	.1655E-02	.6516E-04	21.93	19.96
12.41	.484	11715	.2149E-02	.8654E-04	22.74	20.69
13.33	.524	12123	.2141E-02	.8630E-04	23.48	21.37
14.08	.554	12443	.2631E-02	.1016E-03	24.23	22.05
15.24	.572	12847	.2743E-02	.1095E-03	24.97	22.72
15.84	.574	13133	.2610E-02	.1027E-03	25.62	23.32
17.03	.555	13433	.3642E-02	.1433E-03	26.28	23.91
17.47	.584	13670	.4345E-02	.1594E-03	27.02	24.59
18.54	.733	13933	.4141E-02	.1630E-03	27.77	25.27
19.42	.765	14145	.4674E-02	.1843E-03	28.73	26.15
20.10	.835	145.3	.6345E-02	.2494E-03	29.44	27.24
20.70	.894	14751	.5932E-02	.2336E-03	31.14	28.34
24.43	.164	15351	.7814E-02	.3075E-03	32.38	29.47
26.27	1.134	15247	.9614E-02	.3623E-03	33.58	30.55
26.12	1.103	15434	.1137E-01	.4444E-03	34.55	31.46
27.24	1.143	15531	.1162E-01	.4574E-03	35.57	32.17
28.14	1.136	15754	.1143E-01	.4444E-03	36.80	33.11
28.37	1.175	15843	.1411E-01	.5342E-03	37.60	34.22
29.74	1.174	15965	.1674E-01	.6034E-03	38.62	35.14
30.14	1.403	16244	.1744E-01	.7023E-03	39.76	36.19
32.00	1.432	16174	.2441E-01	.9839E-03	40.94	37.29
33.47	1.554	16234				

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2024-T861 AND 2124-T851

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TABLE D1-28

SPECIMEN NUMBER:	U63-114
ALLOY TYPE:	2024-T861
SPECIMEN ORIENTATION:	LONGITUDINAL
CONSTRAINT:	UNSTIFFENED
ENVIRONMENT:	AIRCON
TEST TEMPERATURE:	284.3 K
SPECIMEN THICKNESS:	1.65 MM (.0650 IN)
MAXIMUM STRESS:	217.6 MPa (31.6 KSI)
R-RATIO:	.05
FREQUENCY:	200 CPM
CYCLES TO FAILURE:	1170 CYCLES
K(MAX) 12 CYCLES PRIOR TO FAILURE:	57.10 MPa SQRT(IN) (52.03 KSI SQRT(IN))

CRACK LENGTH		CYCLES	DELTA (A1)/DELTA (A2)		DELTA (STRESS INTENSITY)	
MM	IN		MM/CYCLE	IN/CYCLE	MPa SQRT(IN)	KSI SQRT(IN)
4.12	.162	1	.3450E-02	.1358E-03	24.97	22.63
5.09	.200	242	.4674E-02	.1840E-03	27.62	24.99
5.77	.227	427	.6476E-02	.3337E-03	28.79	26.26
6.95	.298	519	.6798E-02	.2641E-03	30.86	28.08
7.60	.299	675	.9873E-02	.3887E-03	32.95	29.90
8.52	.335	769	.1040E-01	.4093E-03	34.77	31.64
9.41	.373	856	.1230E-01	.4842E-03	36.91	33.23
10.34	.407	939	.1985E-01	.7016E-03	38.26	34.92
11.32	.440	979	.2293E-01	.8871E-03	39.88	36.22
12.11	.477	1014	.3212E-01	.1269E-02	41.32	37.60
13.10	.514	1045	.3321E-01	.1387E-02	42.87	39.31
14.00	.551	1072	.4916E-01	.1939E-02	44.25	40.27
14.83	.584	1089	.5193E-01	.2044E-02	45.62	41.92
15.77	.621	1117	.4932E-01	.1942E-02	47.00	42.77
16.66	.656	1125	.5623E-01	.2214E-02	48.40	44.34
17.47	.696	1141	.1704E+00	.6729E-02	50.11	45.68
19.03	.749	1151	.1590E+00	.4260E-02	52.71	47.97
21.42	.843	1166				

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TABLE D1-29

CRACK LENGTH		CYCLES	DELTA(I)/DELTA(II)		DELTA(II)/DELTA(I)	DELTA(II)/DELTA(I)	DELTA(II)/DELTA(I)
IN	MM		MM/CYCLE	IN/CYCLE	MPA SQR(T IN)	INTENSITY	INTENSITY
7.94	.313	1	.1916E-03	.7544E-05	11.40	10.40	
8.76	.345	4276	.1971E-03	.7759E-05	12.00	10.92	
9.47	.373	7859	.2326E-03	.9156E-05	12.43	11.31	
10.09	.397	10513	.3305E-03	.1333E-04	12.66	11.71	
10.65	.427	12764	.3227E-03	.1274E-04	13.33	12.13	
11.61	.457	15137	.3093E-03	.1533E-04	13.77	12.53	
12.32	.485	16961	.4454E-03	.1754E-04	14.25	12.97	
13.29	.523	19120	.2858E-03	.1129E-04	14.60	13.36	
13.86	.546	21123	.4779E-03	.1802E-04	15.07	13.72	
14.73	.580	22944	.3460E-03	.1369E-04	15.52	14.12	
15.53	.611	25250	.6279E-03	.2472E-04	15.97	14.48	
16.26	.640	26417	.4961E-03	.1953E-04	16.31	14.84	
17.06	.672	28035	.5992E-03	.2399E-04	16.85	15.33	
18.45	.726	30343	.1004E-02	.3953E-04	17.44	15.87	
19.49	.767	3179	.9749E-03	.3036E-04	18.14	16.51	
21.42	.843	3160	.9797E-03	.3057E-04	18.96	17.20	
22.82	.898	34795	.1552E-02	.6110E-04	19.53	17.77	
24.22	.954	35696	.1580E-02	.6220E-04	20.19	18.38	
25.88	1.019	36749	.2072E-02	.8159E-04	20.85	18.98	
27.31	1.075	37436	.2011E-02	.7910E-04	21.44	19.51	
28.66	1.128	38186	.2043E-02	.1119E-03	22.12	20.13	
30.00	1.205	38789	.3030E-02	.1196E-03	22.80	20.82	
32.30	1.275	39375	.2924E-02	.1150E-03	23.55	21.43	
33.96	1.337	39917	.4151E-02	.1634E-03	24.21	22.04	
35.69	1.405	40334	.5830E-02	.1972E-03	24.92	22.66	
37.56	1.479	40706	.4071E-02	.1910E-03	25.54	23.24	
38.83	1.529	40967	.5478E-02	.2153E-03	26.15	23.80	
40.88	1.632	41336	.6406E-02	.2522E-03	26.79	24.38	
42.12	1.658	41531	.6747E-02	.2696E-03	27.42	24.95	
43.89	1.728	41793	.9277E-02	.3653E-03	28.00	25.56	
45.53	1.793	41970	.1037E-01	.4084E-03	28.77	26.19	
47.44	1.868	42154	.0021E-02	.3473E-03	29.40	26.76	
48.75	1.919	42302	.1105E-01	.6352E-03	29.99	27.38	
50.46	1.987	42457	.1250E-01	.4952E-03	30.62	27.86	
51.89	2.043	42571	.1195E-01	.6703E-03	31.19	28.39	
53.36	2.101	42694	.1580E-01	.6250E-03	31.80	28.94	
54.92	2.162	42792	.1426E-01	.5616E-03	32.47	29.55	
56.70	2.232	42917	.2071E-01	.8153E-03	33.14	30.16	
58.19	2.291	42930					

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TABLE D1-20

SPECIMEN NUMBER: 2024-T861
SPEICMEN ORIENTATION: 0°
CONSTRAINT: FREE
TEST EQUIPMENT: INSTRON
SPECIMEN THICKNESS: 1.85 MM
MAXIMUM STRESS: 74.5 MPa (10.8 KSI)
CYCLES TO FAILURE: 8655
K(MAX): 51 CYCLES PRIOR TO FAILURE
41.03 MPa SQRT(IN) 37.34 KSI SQRT(IN)

CRACK LENGTH MM	IN	CYCLES	DELTA (A)/DELTA (IN) MM/CYCLE	DELTA (A)/DELTA (IN) IN/CYCLE	DELTA (STRESS INTENSITY) MPa SQRT(IN)	DELTA (STRESS INTENSITY) KSI SQRT(IN)
7.49	.295		.7077E-04	.2706E-05	11.10	10.10
8.12	.320	8956	.1198E-03	.4529E-05	11.70	10.65
9.19	.362	10274	.1091E-03	.4136E-05	12.41	11.29
10.26	.404	28454	.2906E-03	.1160E-04	12.92	11.76
10.81	.426	30790	.1500E-03	.5930E-05	13.27	12.07
11.40	.449	34220	.2243E-03	.8032E-05	13.63	12.41
12.04	.474	37045	.3029E-03	.1192E-04	14.04	12.77
12.79	.503	39519	.2102E-03	.8511E-05	14.45	13.15
13.50	.531	42797	.3374E-03	.1327E-04	14.87	13.54
14.32	.564	45254	.3015E-03	.1502E-04	15.33	13.95
15.17	.597	47460	.4070E-03	.1606E-04	15.71	14.29
15.77	.621	48944	.4023E-03	.1895E-04	16.03	14.59
16.43	.647	50310	.5201E-03	.2079E-04	16.40	14.92
17.21	.677	51703	.5712E-03	.2249E-04	16.82	15.30
18.11	.713	53360	.7931E-03	.3122E-04	17.21	15.66
18.83	.741	54274	.8005E-03	.3179E-04	17.76	16.16
20.41	.804	58233	.1092E-02	.4308E-04	18.43	16.70
21.71	.855	57426	.1144E-02	.4305E-04	19.03	17.32
23.05	.907	58622	.1504E-02	.6156E-04	19.66	17.89
24.54	.966	59574	.1727E-02	.6801E-04	20.30	18.46
26.01	1.024	60422	.1800E-02	.7402E-04	20.92	19.04
27.44	1.080	61193	.2192E-02	.8029E-04	21.56	19.62
29.05	1.144	61923	.2777E-02	.1093E-03	22.10	20.19
30.43	1.190	62422	.3279E-02	.1291E-03	22.79	20.74
32.02	1.261	62905	.3000E-02	.1452E-03	23.43	21.32
33.63	1.324	63341	.4754E-02	.1872E-03	24.09	21.93
35.33	1.391	63699	.3759E-02	.1400E-03	24.71	22.49
36.74	1.447	64076	.6473E-02	.2540E-03	25.29	23.02
38.29	1.507	64314	.5743E-02	.2261E-03	25.90	23.57
39.84	1.560	64944	.6029E-02	.2720E-03	26.51	24.12
41.40	1.630	64010	.6014E-02	.2603E-03	27.07	24.64
42.74	1.663	65007	.7711E-02	.3036E-03	27.61	25.12
44.14	1.730	65100	.9757E-02	.3841E-03	28.11	25.58
45.34	1.785	65311	.8375E-02	.3297E-03	28.63	26.06
46.81	1.843	65406	.1174E-01	.4609E-03	29.18	26.56
48.19	1.896	65601	.9479E-02	.3732E-03	29.75	27.05
49.71	1.957	65745	.1253E-01	.4934E-03	30.30	27.56
50.95	2.024	65864	.1939E-01	.6050E-03	30.97	28.19
53.09	2.090	66003	.2163E-01	.6515E-03	31.60	28.83
54.49	2.145	66060	.2200E-01	.6699E-03	32.33	29.42
56.33	2.210	66151	.1909E-01	.7517E-03	32.94	29.97
57.47	2.263	66211	.2404E-01	.9779E-03	33.52	30.60
59.16	2.329	66279	.2434E-01	.1050E-03	34.14	31.07
60.56	2.382	66334	.3000E-01	.1491E-02	34.75	31.62
62.05	2.443	66376	.3040E-01	.1397E-02	35.36	32.10
63.36	2.494	66414	.4996E-01	.1951E-02	36.10	32.91
65.70	2.590	66463	.6779E-01	.2609E-02	37.01	33.60
67.21	2.646	66484	.4667E-01	.1837E-02	37.70	34.31
68.49	2.712	66520	.5004E-01	.2317E-02	38.20	34.84
69.77	2.747	66539	.5194E-01	.2805E-02	38.60	35.13
70.20	2.767	66545	.5912E-01	.2170E-02	38.85	35.35
70.86	2.789	66555				

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TABLE D1-31

SPECIMEN NUMBER: 463-573				UNTESTED		
ALLOY TYPE: 2024-T861				UNTESTED		
SPECIMEN ORIENTATION: 180°				UNTESTED		
CRACK LENGTH: 1.50 IN				UNTESTED		
TEST TEMPERATURE: 101.1 NPA (11.7 KSI)				UNTESTED		
SPECIMEN THICKNESS: 1.50 IN				UNTESTED		
MAXIMUM STRESS: 101.1 NPA (11.7 KSI)				UNTESTED		
FREQUENCY: 200 CPS				UNTESTED		
CYCLES TO FAILURE: 1224 CYCLES				UNTESTED		
K(MAX): 375 CYCLES PRIOR TO FAILURE				UNTESTED		
				31.67 NPA SQRT(IN) (28.02 KSI SQRT(IN))		
CRACK LENGTH IN	IN	CYCLES	MM/CYCLE	IN/CYCLE	DELTA (STRESS INTENSITY) NPA SQRT(IN)	DELTA (STRESS INTENSITY) KSI SQRT(IN)
5.29	.200	1	.3121E-03	.1229E-04	12.06	11.70
6.10	.240	2997	.4212E-03	.1650E-04	13.76	12.92
6.93	.273	4560	.7283E-03	.2836E-04	14.65	13.34
7.09	.309	9833	.0790E-03	.3449E-04	15.52	14.13
8.72	.343	6833	.1110E-02	.4370E-04	16.26	14.79
9.44	.372	7476	.1356E-02	.5338E-04	16.94	15.42
10.20	.405	8897	.1637E-02	.6467E-04	17.69	16.10
11.10	.440	8650	.1629E-02	.6398E-04	18.40	16.74
12.01	.473	9150	.2504E-02	.1009E-03	19.10	17.30
12.96	.510	9529	.2507E-02	.9870E-04	19.00	18.02
13.83	.544	9674	.2914E-02	.1147E-03	20.47	18.63
14.78	.582	10280	.3829E-02	.1587E-03	21.89	19.20
15.59	.612	10402	.4995E-02	.1809E-03	21.01	19.67
16.25	.640	10554	.4919E-02	.1777E-03	22.15	20.10
17.11	.674	10745	.7995E-02	.3140E-03	22.77	20.73
18.09	.712	10867	.6120E-02	.2413E-03	23.40	21.30
19.00	.740	11016	.0701E-02	.3420E-03	24.17	21.99
20.46	.806	11104	.0102E-02	.3190E-03	25.15	22.89
22.11	.870	11207	.1426E-01	.5613E-03	26.15	23.00
23.75	.935	11502	.1319E-01	.5193E-03	27.10	24.74
25.35	1.006	11639	.1920E-01	.7961E-03	28.12	25.99
26.97	1.062	11713	.1413E-01	.6351E-03	28.93	26.33
28.30	1.117	11800	.2755E-01	.1005E-02	29.71	27.04
29.75	1.170	11849				

TABLE D1-32

SPECIMEN NUMBER: 463-573				UNTESTED		
ALLOY TYPE: 2024-T861				UNTESTED		
SPECIMEN ORIENTATION: 180°				UNTESTED		
CRACK LENGTH: 1.50 IN				UNTESTED		
TEST TEMPERATURE: 101.1 NPA (11.7 KSI)				UNTESTED		
SPECIMEN THICKNESS: 1.50 IN				UNTESTED		
MAXIMUM STRESS: 101.1 NPA (11.7 KSI)				UNTESTED		
FREQUENCY: 200 CPS				UNTESTED		
CYCLES TO FAILURE: 708 CYCLES				UNTESTED		
K(MAX): 2 CYCLES PRIOR TO FAILURE				UNTESTED		
				53.01 NPA SQRT(IN) (48.25 KSI SQRT(IN))		
CRACK LENGTH IN	IN	CYCLES	MM/CYCLE	IN/CYCLE	DELTA (STRESS INTENSITY) NPA SQRT(IN)	DELTA (STRESS INTENSITY) KSI SQRT(IN)
4.83	.190	1	.6704E-02	.1060E-03	24.47	22.27
5.06	.231	228	.5470E-02	.2194E-03	26.94	24.16
6.70	.264	373	.1000E-01	.6203E-03	28.10	25.64
7.45	.293	442	.1356E-01	.9300E-03	29.90	26.91
8.13	.320	492	.1490E-01	.5890E-03	31.20	28.46
9.20	.385	569	.4630E-01	.1026E-02	32.47	30.46
10.63	.410	590	.2220E-01	.6771E-03	35.66	32.45
11.94	.470	657	.4940E-01	.1789E-02	37.51	34.13
12.99	.511	680	.1110E-00	.4369E-02	39.37	35.83
14.43	.560	693	.1092E+00	.4300E-02	41.19	37.49
15.92	.611	723	.2650E+00	.1043E-01	43.90	39.66
17.91	.705	712	.6924E+00	.2726E-01	47.02	43.92
22.06	.869	710				

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TABLE D1-33

SPECIMEN NUMBER: U63-2L12
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
ENVIRONMENT: NET AIR
TEST TEMPERATURE: 300.0 K
SPECIMEN THICKNESS: 1.61 MM (.0635 IN)
MAXIMUM STRESS: 75.2 MPA (10.9 KSI)
R-RATIO: .65
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 46457 CYCLES
K(MAX) 1 CYCLES PRIOR TO FAILURE: 52.66 MPA SQRT(MN): 47.94 KSI SQRT(IN)

CRACK LENGTH MM IN	IN	CYCLES	DELTA (A)/DELTA (N) MM/CYCLE IN/CYCLE	DELTA (STRESS INTENSITY) MPA SQRT(MN) KSI SQRT(IN)
7.65	.278	1	.2331E-03	.7997E-05
7.64	.278	3102	.2368E-03	.9402E-05
8.27	.299	5973	.2409E-03	.9485E-05
9.05	.316	8431	.2638E-03	.1039E-04
9.76	.334	11493	.2916E-03	.1148E-04
10.69	.367	14354	.3136E-03	.1239E-04
11.20	.391	16332	.3331E-03	.1430E-04
11.94	.410	19343	.3594E-03	.1615E-04
12.67	.439	22359	.4564E-03	.1791E-04
13.40	.458	24969	.4528E-03	.1783E-04
14.18	.494	23479	.4397E-03	.2125E-04
14.98	.490	25137	.5565E-03	.2191E-04
15.60	.614	26262	.6011E-03	.2384E-04
16.47	.644	27721	.7248E-03	.2454E-04
17.36	.694	28933	.7278E-03	.2865E-04
18.15	.711	29877	.8453E-03	.3330E-04
18.96	.746	30949	.9211E-03	.3624E-04
20.23	.791	32449	.1049E-02	.4309E-04
21.15	.852	33647	.1123E-02	.4429E-04
22.04	.827	34941	.1224E-02	.4437E-04
24.32	.857	39921	.1434E-02	.5661E-04
25.63	1.011	35474	.1884E-02	.7427E-04
27.17	1.044	27543	.1987E-02	.7825E-04
28.56	1.125	34353	.2145E-02	.8690E-04
29.74	1.171	34436	.2203E-02	.8674E-04
30.97	1.117	37434	.2724E-02	.1.173E-03
31.62	1.169	19951	.2882E-02	.1.046E-03
32.64	1.174	40471	.2896E-02	.1.047E-03
34.88	1.173	43042	.3193E-02	.1.203E-03
36.71	1.446	41533	.3624E-02	.1.340E-03
38.32	1.454	42034	.3871E-02	.1.524E-03
39.81	1.567	42342	.4121E-02	.1.622E-03
41.23	1.521	42739	.4464E-02	.1.837E-03
42.95	1.691	43116	.4947E-02	.1.952E-03
44.45	1.782	43421	.5961E-02	.2.224E-03
45.87	1.424	43854	.4644E-02	.2.222E-03
47.54	1.644	43452	.5503E-02	.2.167E-03
48.32	1.632	44074	.5792E-02	.2.243E-03
49.79	1.662	44353	.7194E-02	.2.834E-03
51.39	2.071	44574	.1.155E-01	.4.154E-03
F	54.81	44893	.1.253E-02	.3.25E-03
F	54.24	45743	.7870E-02	.3.60E-03

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F	19.71	2.135	46443	.1116E-01	.4800E-03	34.67	31.55
F	21.36	2.416	45641	.1143E-01	.4900E-03	35.35	32.17
F	22.44	2.460	45743	.1190E-01	.7500E-03	36.60	32.76
F	24.39	2.115	45841	.1197E-01	.5900E-03	36.72	33.42
F	25.79	2.590	45943	.1524E-01	.6000E-03	37.37	34.31
F	27.31	2.650	46043	.2544E-01	.1400E-02	38.29	34.85
F	29.85	2.751	46143	.3556E-01	.1400E-02	39.29	35.76
F	31.43	2.823	46233	.2246E-01	.9300E-03	39.96	36.39
F	32.77	2.465	46283	.2794E-01	.1100E-02	40.59	36.94
F	34.17	2.721	46333	.4314E-01	.1733E-02	41.47	37.74
F	36.33	3.115	46383	.1169E-00	.4600E-02	42.76	38.91
F	39.25	3.120	46443	.1219E+00	.4600E-02	44.36	41.35
F	42.71	3.744	46433	.1778E+00	.7000E-02	45.67	41.96
F	44.67	3.413	46443	.3816E+00	.1500E-01	46.73	42.52
F	46.48	3.745	46443	.5397E+00	.2124E-01	47.91	43.62
F	49.14	3.471	46452	.5715E+00	.2290E-01	49.31	44.87
F	49.42	3.460	46456				

TABLE D1-34

SPECIMEN NUMBER: U63-3L1
 ALLOY TYPE: 2024-T861
 SPECIMEN ORIENTATION: LONGITUDINAL
 CONSTRAINT: UNSTIFFENED
 ENVIRONMENT: WET AIR
 TEST TEMPERATURE: 303.9 K
 SPECIMEN THICKNESS: 1.63 MM (.0640 IN)
 MAXIMUM STRESS: 110.6 MPA (15.9 KSI)
 R-RATIO: .05
 FREQUENCY: 200 CPM
 CYCLES TO FAILURE: 7313 CYCLES
 K(MAX) 1 CYCLES PRIOR TO FAILURE 57.81 MPA SQRT(M) 51.88 KSI SQRT(IN)

CRACK LENGTH MM	IN	CYCLES	DELTA(S)/DELTA(M) MM/CYCLE	IN/CYCLE	DELTA(STRESS INTENSITY) MPA SQRT(M)	KSI SQRT(IN)
9.62	.116	1	.0607E-03	.2523E-04	10.56	16.84
9.89	.124	1663	.1193E-02	.4607E-04	14.52	17.77
9.96	.124	2374	.1621E-02	.6303E-04	20.25	16.43
10.42	.129	2736	.2081E-02	.8201E-04	20.91	19.03
11.18	.139	1103	.1612E-02	.6348E-04	21.95	19.61
11.85	.148	3453	.2514E-02	.9904E-04	22.14	21.20
12.65	.156	3771	.2740E-02	.1002E-03	22.81	23.82
13.26	.163	4027	.2787E-02	.1097E-03	23.61	21.48
14.30	.177	4366	.3363E-02	.1563E-03	24.46	22.26
15.75	.196	4633	.2994E-02	.1103E-03	25.28	23.01
16.27	.202	4943	.5396E-02	.2002E-03	26.09	23.74
17.25	.215	5153	.4447E-02	.1741E-03	26.90	24.55
18.52	.231	5416	.5347E-02	.2144E-03	27.80	25.10
19.48	.243	5533	.5571E-02	.2191E-03	28.50	25.95
20.42	.254	5754	.6495E-02	.2354E-03	29.30	26.74
21.81	.271	5972	.7673E-02	.2961E-03	30.92	27.77
23.54	.293	6211	.9372E-02	.3640E-03	31.99	28.75
24.87	.309	6366	.1104E-01	.4394E-03	32.64	29.71

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	26.66	1.49	6516	.1505E-01	.5924E-03	33.92	33.86
	28.64	1.127	6639	.1352E-01	.5325E-03	35.89	31.93
	30.14	1.184	6753	.1774E-01	.5959E-03	36.13	32.48
	31.86	1.254	6853	.1862E-01	.7338E-03	37.26	33.91
	33.71	1.327	6903	.2211E-01	.8703E-03	38.53	35.16
	34.83	1.411	7159	.2883E-01	.1139E-02	39.63	36.16
	37.14	1.466	7176	.3598E-01	.1781E-02	40.44	36.82
F	38.48	1.515	7164	.3332E-01	.1382E-02	41.37	37.65
F	40.13	1.543	7193	.3813E-01	.1500E-02	42.36	38.55
F	41.66	1.549	7233	.5927E-01	.2333E-02	43.38	39.48
F	43.43	1.711	7264	.6773E-01	.2667E-02	44.57	40.56
F	45.47	1.791	7291	.1778E-01	.7803E-02	45.47	41.38
F	46.36	1.925	7294	.2563E-01	.1003E-01	46.14	41.99
F	47.62	1.475	7333	.8306E-01	.2488E-01	47.49	43.22
F	51.67	1.975	7339	.1691E-01	.6583E-01	49.49	45.84
F	53.67	2.125	7317	.1774E-01	.7638E-01	51.11	46.51
F	56.75	2.105	7311	.3411E-01	.1538E-00	52.91	49.15
F	59.56	2.145	7312				

TABLE D1-35

SPECIMEN NUMBER: U63-2L13
 ALLOY TYPE: 2024-T861
 SPECIMEN ORIENTATION: LONGITUDINAL
 CONSTRAINT: UNSTIFFENED
 ENVIRONMENT: DRY AIR
 TEST TEMPERATURE: 302.8 K
 SPECIMEN THICKNESS: 1.63 MM (1.660 IN)
 MAXIMUM STRESS: 225.5 MPA (32.7 KSI)
 R-RATIO: .05
 FREQUENCY: 280 CPM
 CYCLES TO FAILURE: 656 CYCLES
 REMARKS: 1 CYCLE PRIOR TO FAILURE: 69.38 MPA SORT(MIN); 63.86 KSI SORT(MIN)

	CRACK LENGTH MM	IN	CYCLES	DELTA (Δ) / DELTA (Δ) MM / CYCLE	IN / CYCLE	DELTA (Δ) STRESS MPA SORT(MIN)	INTENSITY KSI SORT(MIN)
	4.90	.192	1	.0999E-02	.3941E-03	33.33	30.33
	4.47	.173	175	.9034E-02	.1554E-03	35.80	32.58
	4.74	.186	261	.1392E-01	.6323E-03	37.45	34.79
	5.12	.201	325	.1644E-01	.5888E-03	38.66	35.18
	5.29	.208	381	.2754E-01	.1084E-02	39.76	36.18
	5.12	.201	424	.1934E-01	.7123E-03	41.24	37.53
	5.80	.228	473	.1531E-01	.6097E-03	42.57	38.74
	5.14	.202	515	.2613E-01	.9581E-03	44.07	40.11
	5.35	.210	561	.5827E-01	.2215E-02	46.18	42.82
	5.23	.206	555	.6257E-01	.2464E-02	46.84	43.72
	5.72	.225	595	.3711E-01	.1464E-02	49.86	45.38
	5.16	.203	661	.8122E-01	.3198E-02	53.71	48.88
F	5.24	.206	647	.2476E-01	.1172E-01	57.96	52.38
F	5.26	.207	652	.2832E-01	.8888E-02	59.46	54.39
F	5.78	.227	693	.4645E-01	.1758E-01	63.81	57.34

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SPECIMEN NUMBER1				U63-872			
ALLOY TYPE2				2024-T861			
SPECIMEN ORIENTATION3				TRANSVERSE			
CONSTRAINT4				UNSTRESS			
ENVIRONMENT5				AIR			
TEST TEMPERATURE6				81.0 K			
SPECIMEN THICKNESS7				1.65 MM (1.80E-01 IN)			
MAXIMUM STRESS8				74.5 MPa (10.8 KSI)			
FREQUENCY9				288 CPM			
CYCLES TO FAILURE10				48236 CYCLES			
KIMAX1				31.79 MPa SQRT(IN) (28.93 KSI SQRT(IN))			
CRACK LENGTH		CYCLES	DELTA (A) / DELTA (H)		DELTA (STRESS INTENSITY)		
MM	IN		MM/CYCLE	IN/CYCLE	MPa SQRT(IN)	KSI SQRT(IN)	
6.82	.269	1	.1021E-03	.7166E-05	10.59	9.63	
7.38	.291	3070	.2514E-03	.9099E-05	11.08	10.09	
8.17	.322	6235	.1672E-03	.6503E-05	11.59	10.94	
8.82	.347	10046	.2011E-03	.1107E-04	12.08	10.99	
9.63	.379	12991	.3077E-03	.1211E-04	12.57	11.44	
10.33	.407	15249	.3614E-03	.1423E-04	13.01	11.84	
11.05	.435	17238	.3201E-03	.1292E-04	13.42	12.22	
11.69	.460	19193	.4376E-03	.1723E-04	13.81	12.56	
12.34	.486	20673	.4799E-03	.1809E-04	14.20	12.93	
13.07	.515	22206	.4938E-03	.1944E-04	14.58	13.27	
13.68	.539	23440	.4806E-03	.1916E-04	14.90	13.56	
14.24	.560	24970	.7056E-03	.2778E-04	15.34	13.96	
15.31	.603	26999	.6509E-03	.2586E-04	15.83	14.40	
16.09	.633	27290	.6831E-03	.2689E-04	16.19	14.73	
16.72	.658	28214	.9503E-03	.3741E-04	16.52	15.04	
17.41	.685	28933	.9832E-03	.3477E-04	16.85	15.33	
18.03	.710	29639	.9534E-03	.3754E-04	17.24	15.69	
19.02	.749	30602	.1255E-02	.4442E-04	17.81	16.21	
20.43	.804	31006	.1256E-02	.4944E-04	18.46	16.80	
21.78	.858	32881	.1536E-02	.6046E-04	19.15	17.43	
23.49	.925	33995	.1034E-02	.7219E-04	19.91	18.12	
25.24	.994	34948	.2313E-02	.9186E-04	20.62	18.76	
26.75	1.053	35596	.2924E-02	.1151E-03	21.27	19.36	
28.33	1.115	36140					
30.05	1.183	36754	.2807E-02	.1105E-03	21.96	19.98	
31.79	1.292	37238	.3592E-02	.1414E-03	22.67	20.63	
33.12	1.304	37590	.3894E-02	.1454E-03	23.29	21.19	
34.36	1.353	37854	.4809E-02	.1893E-03	23.88	21.86	
35.97	1.416	38192	.4793E-02	.1887E-03	24.37	22.18	
37.32	1.449	38455	.5099E-02	.2008E-03	24.95	22.71	
38.94	1.533	38882	.7161E-02	.2819E-03	25.94	23.24	
40.84	1.608	38886	.9295E-02	.3699E-03	26.23	23.87	
42.58	1.676	39046	.8786E-02	.3427E-03	26.93	24.51	
44.82	1.733	39268	.7934E-02	.3124E-03	27.96	25.88	
45.86	1.806	39410	.1309E-01	.5155E-03	28.28	26.68	
47.41	1.886	39533	.1246E-01	.4882E-03	28.86	26.26	
48.61	1.914	39612	.1519E-01	.4981E-03	29.39	26.75	
50.07	1.971	39735	.1569E-01	.6177E-03	29.91	27.22	

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TABLE D1-37

SPECIMEN NUMBER: 1062-373 ALLOY TYPE: 2024-T861 SPECIMEN ORIENTATION: T861-T861 CONSTRAINT: UNSTRESS TEST TEMPERATURE: 70 F SPECIMEN THICKNESS: 1.63 MM (1/16 IN) MAXIMUM STRESS: 110.8 MPa (15.9 KSI) FREQUENCY: 200 CPS CYCLES TO FAILURE: 398 K(MAX): 398 CYCLES PRIOR TO FAILURE 33.96 MPa SQRT(IN) (30.98 KSI SQRT(IN))						
CRACK LENGTH MM	IN	CYCLES	DELTA (A)/DELTA (H) MM/CYCLE IN/CYCLE		DELTA (STRESS INTENSITY) MPa SQRT(IN) KSI SQRT(IN)	
8.28	.329	1	.1491E-02	.5884E-04	18.63	16.96
9.22	.363	753	.1753E-02	.6988E-04	19.66	17.89
10.85	.429	1224	.2998E-02	.1188E-03	20.98	18.66
10.89	.429	1589	.2488E-02	.9763E-04	21.24	19.33
11.97	.475	1779	.3678E-02	.1445E-03	21.91	19.94
12.38	.484	1978	.3489E-02	.1346E-03	22.58	20.95
13.03	.513	2191	.4641E-02	.1827E-03	23.23	21.14
13.76	.542	2358	.9864E-02	.2238E-03	23.90	21.79
14.54	.572	2487	.6615E-02	.2604E-03	24.57	22.36
15.33	.604	2687	.6288E-02	.2444E-03	25.22	22.95
16.11	.634	2732	.6840E-02	.2696E-03	25.90	23.57
17.08	.669	2862	.1055E-01	.4152E-03	26.54	24.16
17.73	.696	2931	.1113E-01	.4387E-03	27.16	24.72
18.57	.731	3087	.1280E-01	.4961E-03	27.88	25.38
19.38	.763	3871	.1232E-01	.4892E-03	28.56	25.99
20.59	.811	3169	.1342E-01	.5282E-03	29.88	26.85
21.94	.864	3278	.1824E-01	.7188E-03	30.51	27.77
23.40	.921	3352	.2359E-01	.9287E-03	31.85	28.88
25.17	.991	3429				

TABLE D1-38

SPECIMEN NUMBER: 1062-373 ALLOY TYPE: 2024-T861 SPECIMEN ORIENTATION: T861-T861 CONSTRAINT: UNSTRESS TEST TEMPERATURE: 70 F SPECIMEN THICKNESS: 1.63 MM (1/16 IN) MAXIMUM STRESS: 198.7 MPa (28.4 KSI) FREQUENCY: 200 CPS CYCLES TO FAILURE: 293 K(MAX): 13 CYCLES PRIOR TO FAILURE 45.46 MPa SQRT(IN) (41.37 KSI SQRT(IN))						
CRACK LENGTH MM	IN	CYCLES	DELTA (A)/DELTA (H) MM/CYCLE IN/CYCLE		DELTA (STRESS INTENSITY) MPa SQRT(IN) KSI SQRT(IN)	
6.74	.265	1	.1193E-01	.4538E-03	28.43	25.88
7.67	.302	81	.1539E-01	.6068E-03	29.95	27.26
8.31	.327	123	.1862E-01	.7329E-03	31.28	28.48
9.02	.355	161	.2485E-01	.9783E-03	32.58	29.57
9.77	.384	191	.3211E-01	.1264E-02	33.82	30.76
10.57	.416	218	.4788E-01	.1882E-02	35.47	32.28
11.76	.463	241	.4888E-01	.1848E-02	37.24	33.94
12.89	.507	245	.1261E-00	.4966E-02	40.73	37.67
16.42	.646	293				

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TABLE D1-39

SPECIMEN NUMBER: 82-213
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: STRESS
TEST ENVIRONMENT: LAB AIR
TEST TEMPERATURE: 68 F
SPECIMEN THICKNESS: 1.01 MM (1.963E-03 IN)
MAXIMUM STRESS: 117.2 MPA (17.0 KSI)
FREQUENCY: 280 CPM
CYCLES TO FAILURE: 30686 CYCLES
K(MAX): 69.35 MPA SQRT(M) (63.12 KSI SQRT(IN))
% CYCLES PRIOR TO FAILURE: 69.35

CRACK LENGTH MM IN	IN	CYCLES	DELTA(K)/DELTA(N) MM/CYCLE IN/CYCLE	DELTA(Stress Intensity) MPA SQRT(M) KSI SQRT(IN)
2.98	.117		.1195E-03	.4706E-05
3.91	.154	7821	.2195E-03	.8642E-05
4.73	.186	11541	.3008E-03	.1184E-04
5.40	.213	13787	.3470E-03	.1366E-04
6.05	.238	15646	.4395E-03	.1731E-04
6.68	.263	17082	.5903E-03	.2324E-04
7.26	.286	18063	.6857E-03	.2700E-04
7.97	.312	19039	.7369E-03	.2901E-04
8.52	.335	19637	.8173E-03	.3210E-04
9.19	.362	20659	.9100E-03	.3583E-04
9.96	.393	21514	.1664E-02	.6551E-04
10.78	.424	22011	.1123E-02	.4420E-04
11.40	.449	22563	.1647E-02	.6483E-04
12.15	.479	23035	.1683E-02	.6628E-04
12.65	.499	23336	.1591E-02	.6264E-04
13.34	.527	23775	.2313E-02	.9100E-04
14.00	.551	24044	.2061E-02	.9143E-04
14.58	.574	24324	.2527E-02	.9958E-04
15.34	.604	24625	.2851E-02	.1123E-03
16.38	.633	24882	.2658E-02	.1046E-03
16.85	.663	25173	.3691E-02	.1437E-03
17.55	.691	25365	.2533E-02	.1020E-03
18.28	.720	25646	.3040E-02	.1197E-03
18.86	.743	25839		
19.47	.767	26021	.3342E-02	.1316E-03
20.82	.820	26327	.4403E-02	.1734E-03
22.13	.871	26614	.4486E-02	.1766E-03
23.44	.923	26866	.5295E-02	.2085E-03
24.80	.976	27099	.5832E-02	.2296E-03
26.19	1.031	27339	.5784E-02	.2277E-03
27.61	1.107	27574	.6042E-02	.2379E-03
28.84	1.135	27769	.6337E-02	.2495E-03
30.05	1.183	27949	.6724E-02	.2647E-03
31.30	1.232	28128	.6953E-02	.2737E-03
32.60	1.283	28290	.8123E-02	.3197E-03
33.90	1.338	28452	.8929E-02	.3398E-03
35.20	1.389	28591	.9365E-02	.3687E-03
36.69	1.445	28741	.9423E-02	.3710E-03
37.95	1.494	28850	.1197E-01	.4555E-03
F	40.64	29856	.1304E-01	.5133E-03
F	42.67	29286	.1395E-01	.5333E-03
F	46.86	29506	.1397E-01	.5580E-03
F	48.64	29606	.1778E-01	.7808E-03
F	49.78	29706	.1143E-01	.4588E-03
F	51.31	29826	.1524E-01	.6008E-03
F	52.83	29926	.1524E-01	.6008E-03
F	55.24	30006	.2413E-01	.9980E-03
F	57.53	30136	.2286E-01	.9880E-03
F	60.45	30181	.3895E-01	.1533E-02
F	64.26	30331	.2540E-01	.1088E-02
F	66.93	30426	.3556E-01	.1488E-02
F	72.64	30501	.6816E-01	.2368E-02
F	76.83	30546	.9313E-01	.3667E-02

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TABLE D1-40

SPECIMEN NUMBER: 63-217
ALLOY TYPE: 2124-T851
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: STRESS
TEST TEMPERATURE: 622.0 K
SPECIMEN THICKNESS: 1.64 MM (.064 IN)
MAXIMUM STRESS: 145.0 MPA (20.4 KSI)
FREQUENCY: 288 CPS
CYCLES TO FAILURE: 3893 CYCLES
MINAX: 2 CYCLES PRIOR TO FAILURE 78.17 MPA SORT(M) 71.14 KSI SORT(M)

CRACK LENGTH MM	CRACK LENGTH IN	CYCLE	DELTA(A)/DELTA(N) MM/CYCLE	DELTA(A)/DELTA(N) IN/CYCLE	DELTA(STRESS INTENSITY) MPA SORT(M)	DELTA(STRESS INTENSITY) KSI SORT(M)
3.45	.136	783	.6419E-03	.2603E-04	17.01	16.21
3.50	.124	783	.1503E-02	.6919E-04	19.56	17.00
3.65	.152	1226	.1563E-02	.6143E-04	21.29	19.37
4.47	.176	1624	.2119E-02	.8329E-04	22.96	21.89
5.21	.215	1971	.2564E-02	.1010E-03	24.57	22.36
5.45	.231	2231	.2879E-02	.1133E-03	25.93	23.60
6.47	.255	2437	.4023E-02	.1594E-03	27.18	24.74
7.09	.279	2492	.4431E-02	.1768E-03	28.29	25.74
7.54	.299	2713	.6001E-02	.3150E-03	29.59	26.93
8.46	.337	2813	.7235E-02	.2848E-03	30.97	28.19
9.11	.359	2912	.7460E-02	.2937E-03	32.15	29.26
9.82	.386	2997	.9642E-02	.3796E-03	33.95	31.08
11.02	.442	3144	.1439E-01	.5667E-03	35.68	32.47
12.11	.473	3194	.1635E-01	.6074E-03	36.65	33.36
12.50	.492	3245	.1536E-01	.6049E-03	37.65	34.27
13.74	.525	3311	.1650E-01	.6529E-03	38.90	35.40
14.20	.559	3352	.2416E-01	.9513E-03	40.17	36.55
15.12	.595	3411	.1671E-01	.6577E-03	41.11	37.41
15.56	.612	3416	.2411E-01	.9408E-03	42.07	38.29
16.55	.651	3457	.2264E-01	.8912E-03	43.25	39.36
17.32	.682	3491	.3040E-01	.1197E-02	44.85	40.09
17.77	.700	3506	.3641E-01	.1433E-02	44.90	40.87
18.64	.734	3531	.3305E-01	.1301E-02	46.29	42.13
19.97	.786	3570				
21.11	.834	3615	.3476E-01	.1369E-02	47.86	43.55
22.34	.880	3635	.3861E-01	.1523E-02	49.29	44.86
23.94	.944	3666	.5288E-01	.2074E-02	50.94	46.36
26.31	1.036	3637	.7510E-01	.2960E-02	53.22	48.43
30.32	1.194	3741	.9110E-01	.3590E-02	56.75	51.84
33.17	1.312	3765	.1147E+00	.4517E-02	60.39	54.96
35.19	1.345	3776	.1928E+00	.7582E-02	62.96	57.36
36.51	1.438	3782	.2233E+00	.8792E-02	64.77	58.94
38.26	1.505	3767	.3414E+00	.1344E-01	66.35	60.38
39.91	1.571	3791	.4181E+00	.1646E-01	67.89	61.96
42.96	1.691	3797	.5042E+00	.2001E-01	78.91	64.17
45.13	1.775	3801	.5353E+00	.2106E-01	73.17	66.58

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SPECIMEN NUMBERS						
SPECIMEN ORIENTATION						
TEST TEMPERATURE						
SPECIMEN THICKNESS						
MAXIMUM STRESS						
FREQUENCY						
CYCLES TO FAILURE						
K(MAX) 19 CYCLES PRIOR TO FAILURE						
71.90 MPA SQRT(IN) 65.58 KSI SQRT(IN)						
CRACK LENGTH	IN	CYCLES	DELTA(K)/DELTA(N)	DELTA(1)/DELTA(N)	DELTA(STRESS INTENSITY)	DELTA(1)/DELTA(N)
MM			MM/CYCLE	IN/CYCLE	MPA SQRT(IN)	KSI SQRT(IN)
3.04	.120	1	.1337E-03	.5204E-05	11.43	10.40
3.67	.144	4693	.2943E-03	.1190E-04	12.54	11.41
4.40	.173	7179	.3054E-03	.1202E-04	13.47	12.20
4.91	.193	8859	.4600E-03	.1646E-04	14.24	12.96
5.49	.216	10897	.3070E-03	.1523E-04	15.02	13.47
6.07	.239	11507	.6270E-03	.2409E-04	15.00	14.30
6.72	.264	12622	.7160E-03	.2022E-04	16.59	15.10
7.30	.290	13545	.8119E-03	.3196E-04	17.36	15.00
8.04	.316	14360	.9107E-03	.3017E-04	18.09	16.47
8.70	.343	15003	.1210E-02	.4797E-04	18.00	17.11
9.36	.369	15115	.1302E-02	.5126E-04	19.49	17.73
10.03	.395	16139	.1400E-02	.5546E-04	20.10	18.37
10.76	.424	16654	.1973E-02	.7766E-04	20.06	18.90
11.42	.450	16992	.2050E-02	.8101E-04	21.50	19.97
12.13	.478	17337	.1640E-02	.6400E-04	22.05	20.07
12.83	.497	17638	.2931E-02	.1154E-03	22.55	20.52
13.25	.522	17067	.2694E-02	.1061E-03	23.19	21.11
14.00	.555	18161	.2691E-02	.1059E-03	23.08	21.73
14.44	.584	18439	.3426E-02	.1309E-03	24.96	22.35
15.73	.619	18700	.3147E-02	.1239E-03	25.19	22.92
16.37	.645	18933	.3940E-02	.1551E-03	25.04	23.52
17.37	.684	19157	.4150E-02	.1630E-03	26.92	24.13
18.11	.713	19333	.4349E-02	.1712E-03	27.09	24.65
18.65	.742	19535	.5059E-02	.1902E-03	27.03	25.33
20.08	.790	19747	.5779E-02	.2275E-03	28.00	26.21
21.90	.847	19994	.5747E-02	.2267E-03	29.72	27.05
22.63	.891	20109	.7851E-02	.2776E-03	30.59	27.84
23.90	.944	20301	.7994E-02	.3147E-03	31.40	28.65
25.20	.992	20534	.7900E-02	.3145E-03	32.37	29.46
26.61	1.048	20710	.8459E-02	.3330E-03	33.20	30.29
27.93	1.103	20866	.1109E-01	.4079E-03	34.17	31.10
29.32	1.154	20903	.9609E-02	.3815E-03	35.07	31.92
30.71	1.209	21126	.9351E-02	.3601E-03	35.92	32.49
31.97	1.259	21261	.1030E-01	.4054E-03	36.75	33.44
33.30	1.311	21390	.1320E-01	.5227E-03	37.56	34.20
34.61	1.363	21409	.1430E-01	.5601E-03	38.53	35.07
36.35	1.431	21610	.1200E-01	.5040E-03	39.46	35.92
37.04	1.462	21711	.1761E-01	.6934E-03	40.41	36.77
F 39.37	1.550	21809	.2159E-01	.8500E-03	41.00	37.00
F 41.93	1.639	21909	.1909E-01	.7500E-03	42.05	38.99
F 43.43	1.713	22009	.1909E-01	.7500E-03	44.02	40.06
F 45.34	1.785	22109	.2413E-01	.9500E-03	45.34	41.26
F 47.75	1.880	22209	.3302E-01	.1300E-02	46.11	42.07
F 51.05	2.010	22309	.3175E-01	.1290E-02	49.12	44.70
F 54.23	2.135	22409	.2540E-01	.1000E-02	50.93	46.35
F 56.77	2.235	22509	.2794E-01	.1100E-02	52.19	47.50
F 58.17	2.290	22599	.5002E-01	.2300E-02	53.59	48.77
F 61.09	2.405	22609	.4310E-01	.1700E-02	55.27	50.30
F 63.25	2.490	22659	.8346E-01	.3200E-02	56.99	51.67
F 66.17	2.605	22694	.8120E-01	.3200E-02	58.71	53.43
F 68.20	2.645	22719	.9144E-01	.3600E-02	60.25	54.03
F 70.48	2.775	22744	.1609E+00	.6333E-02	61.96	56.39
F 72.90	2.870	22759	.2413E+00	.9500E-02	64.71	58.00
F 77.72	3.060	22779	.1903E+00	.7727E-02	67.44	61.42
F 79.08	3.145	22793				

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TABLE D1-42

SPECIMEN NUMBER: 62-874
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINT: STRESS
TEST CONFIGURATION: CANTILEVER
SPECIMEN THICKNESS: 1.64 MM (0.064 IN)
MAXIMUM STRESS: 199.8 MPA (28.4 KSI)
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 1975
K (N/MM) 2 CYCLES PRIOR TO FAILURE: 56.37 MPA SQRT(IN) (93.12 KSI SQRT(IN))

CRACK LENGTH MM	IN	CYCLES	DELTA (A)/DELTA IN/ MM/CYCLE	DELTA STRESS MPA SQRT(IN)	INTENSITY KSI SQRT(IN)
3.14	.124	1	.1441E-02	.5675E-04	19.47
3.83	.151	475	.2687E-02	.1027E-03	21.81
4.52	.178	739	.2810E-02	.1110E-03	22.09
5.11	.201	949	.5886E-02	.2286E-03	24.46
5.88	.231	1882	.4628E-02	.1819E-03	26.09
6.62	.261	1242	.7674E-02	.3188E-03	27.88
7.58	.298	1362	.8383E-02	.3293E-03	29.46
8.35	.329	1454	.1818E-01	.3978E-03	38.88
9.83	.385	1823	.1455E-01	.5727E-03	31.82
9.51	.376	1954	.1125E-01	.4427E-03	32.76
10.13	.399	1811	.1546E-01	.6886E-03	33.64
10.57	.416	1640	.1811E-01	.7129E-03	34.46
11.14	.438	1671	.1687E-01	.6326E-03	35.58
11.87	.468	1717	.2668E-01	.1067E-02	36.75
12.78	.503	1751	.1621E-01	.6388E-03	37.74
13.18	.519	1776	.2381E-01	.9379E-03	38.93
13.85	.545	1884	.2435E-01	.9586E-03	39.60
14.68	.578	1838	.2841E-01	.1118E-02	40.78
15.53	.611	1868	.4386E-01	.1719E-02	41.84
16.23	.639	1884	.5347E-01	.2189E-02	42.67
16.76	.668	1894	.6178E-01	.2482E-02	43.72
17.81	.701	1911	.7632E-01	.3889E-02	44.94
18.65	.734	1922	.9665E-01	.3889E-02	46.68
20.59	.818	1942	.1871E+00	.4217E-02	48.65
21.87	.861	1954	.1781E+00	.6931E-02	50.29
23.28	.917	1982	.3173E+00	.1249E-01	52.18
25.18	.991	1988	.3896E+00	.1934E-01	54.36
27.13	1.068	1973			

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TABLE D1-43

SPECIMEN NUMBER: U63-011
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
ENVIRONMENT: LAB AIR
TEST TEMPERATURE: 422.0 K
SPECIMEN THICKNESS: 1.65 MM (0.0650 IN)
MAXIMUM STRESS: 114.4 MPA (16.6 KSI)
R-RATIO: .05
FREQUENCY: 288 CPM
CYCLES TO FAILURE: 9029 CYCLES
K(MAX) 1 CYCLES PRIOR TO FAILURE: 66.83 MPA SQRT(M) 60.39 KSI SQRT(IN)

CRACK MM	LENGTH IN	CYCLES	DELTA(K)/DELTA(M) MM/CYCLE	IN/CYCLE	DELTA(Stress Intensity) MPa SQRT(M)	KSI SQRT(IN)
9.61	.340	1	.9565E-03	.3766E-04	18.25	16.61
9.24	.364	637	.1129E-02	.4429E-04	18.90	17.28
9.42	.391	1241	.1235E-02	.4864E-04	19.66	17.89
10.78	.425	1940	.1163E-02	.4578E-04	20.35	18.52
11.39	.444	2461	.1290E-02	.5111E-04	20.84	18.97
11.86	.467	2821	.1993E-02	.7847E-04	21.37	19.45
12.56	.495	3174	.1495E-02	.5897E-04	21.94	19.96
13.15	.515	3564	.2212E-02	.8710E-04	22.91	20.49
13.90	.547	3905	.1994E-02	.7850E-04	23.17	21.38
14.71	.579	4312	.2297E-02	.9042E-04	23.84	21.69
15.54	.612	4672	.2224E-02	.8757E-04	24.33	22.14
15.94	.625	4923	.3195E-02	.1254E-03	24.40	22.57
16.74	.659	5103	.2674E-02	.1053E-03	25.41	23.12
17.41	.689	5388	.3515E-02	.1344E-03	26.07	23.73
18.49	.728	5659	.2464E-02	.9701E-04	26.61	24.22
18.94	.746	5853	.4216E-02	.1646E-03	27.15	24.71
19.07	.746	6037	.4311E-02	.1704E-03	28.07	25.91
21.40	.842	6426	.4484E-02	.1766E-03	29.04	26.43
22.84	.819	6749	.4941E-02	.1945E-03	30.00	27.30
24.14	.883	7022	.6072E-02	.2397E-03	30.90	28.12
25.52	1.005	7241	.6145E-02	.2419E-03	31.75	28.91
26.78	1.054	7445	.6821E-02	.2689E-03	32.55	29.62
27.47	1.111	7673	.6941E-02	.2716E-03	33.38	30.38
29.14	1.157	7821	.6844E-02	.2695E-03	34.11	31.04
30.28	1.192	7954	.7587E-02	.2987E-03	34.94	31.80
32.13	1.261	8144	.9231E-02	.3659E-03	36.37	32.10
34.02	1.274	8411	.1114E-01	.5175E-03	37.50	34.26
35.99	1.417	8576	.1167E-01	.5199E-03	38.29	34.45
37.25	1.446	8634	.1211E-01	.5764E-03	38.96	35.45
38.22	1.494	8771	.1121E-01	.5412E-03	39.65	36.18
39.54	1.557	8817	.1171E-01	.5547E-03	40.36	36.73
40.59	1.614	8955	.1543E-01	.6795E-03	41.10	37.46
42.61	1.663	9143	.1446E-01	.5671E-03	41.91	38.14
43.28	1.714	9182	.1715E-01	.7070E-03	42.91	39.05
45.25	1.745	9247	.1511E-01	.5971E-03	43.05	39.91
46.44	1.828	9311	.1551E-01	.7127E-03	44.63	40.62
47.04	1.844	9422	.2241E-01	.8980E-03	45.40	41.31
48.04	1.924	9445	.2141E-01	.7434E-03	46.27	42.11
50.84	2.017	9521	.3875E-01	.1447E-02	47.14	42.73
51.98	2.046	9594	.4434E-01	.1746E-02	48.14	43.41
F	51.97	9593	.2954E-01	.1000E-02	49.14	44.72
F	55.74	9641				

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F	57.51	2.765	9641	.5715E-01	.2250E-02	50.24	45.72
F	54.44	2.740	9713	.6151E-01	.2503E-02	51.56	46.92
F	51.09	2.515	9774	.8102E-01	.3182E-02	53.60	48.77
F	50.79	2.543	9794	.9525E-01	.3750E-02	55.69	50.60
F	47.94	2.175	9811	.1439E+00	.5667E-02	57.06	51.93
F	49.72	2.745	9813	.1770E+00	.7000E-02	58.42	53.16
F	71.37	2.911	9825	.2752E+00	.1003E-01	59.62	54.26
F	70.84	2.461	9827	.6351E+00	.2500E-01	60.67	55.21
F	74.80	2.945	9824	.2157E+01	.8500E-01	61.93	56.36

TABLE D1-44

SPECIMEN NUMBER: 1153-011
 SPECIMEN ORIENTATION: 1153-011
 TEST TECHNIQUE: 1153-011
 SPECIMEN THICKNESS: 1153-011
 HARDNESS: 1153-011
 CYCLES TO FAILURE: 1153-011
 K(MAX): 2 CYCLES PRIOR TO FAILURE: 1153-011

50.78 MPA SORTING: 53.49 KSI SORTING

CRACK LENGTH MM	IN	CYCLES	DELTA (K)/DELTA (N) MM/CYCLE	IN/CYCLE	DELTA (STRESS INTENSITY) MPA SORTING	KSI SORTING	
9.45	.373		.1031E-02	.4059E-04	9.53	9.66	
9.72	.383	1220	.1261E-02	.4903E-04	10.04	9.12	
10.40	.410	1773	.1443E-02	.5602E-04	10.46	9.91	
11.30	.448	2447	.2009E-02	.7909E-04	10.88	9.90	
12.21	.481	2803	.2397E-02	.9279E-04	11.30	10.20	
13.19	.519	3279	.2171E-02	.8567E-04	11.70	10.85	
14.02	.552	3661	.3039E-02	.1197E-03	12.13	11.03	
15.16	.597	4835	.3599E-02	.1417E-03	12.57	11.44	
16.13	.635	4388	.3166E-02	.1240E-03	12.99	11.82	
17.21	.678	4647	.5316E-02	.2043E-03	13.43	12.22	
18.11	.721	4462	.4579E-02	.1803E-03	13.83	12.59	
19.11	.75	4174	.6409E-02	.2523E-03	14.60	13.18	
21.19	.840	5791	.8542E-02	.3363E-03	15.16	13.90	
23.43	.925	5541	.8536E-02	.3360E-03	15.35	14.00	
25.87	1.010	5919	.1054E-01	.4157E-03	16.75	15.24	
28.19	1.110	8139	.1373E-01	.5400E-03	17.43	15.66	
29.95	1.179	8267	.1439E-01	.5669E-03	18.02	16.68	
31.06	1.254	8488	.1834E-01	.7222E-03	18.84	16.97	
32.81	1.311	8586	.2059E-01	.8109E-03	19.23	17.90	
35.58	1.401	8592	.2218E-01	.8733E-03	19.82	18.84	
37.93	1.478	8688	.2080E-01	.8182E-03	20.41	18.58	
39.36	1.558	8706	.2911E-01	.1166E-02	21.88	19.11	
41.27	1.625	8811	.2789E-01	.1090E-02	21.93	19.59	
42.81	1.685	8886	.2358E-01	.9258E-03	21.91	19.94	
43.75	1.722	8986	.6068E-01	.2781E-02	22.68	20.97	
F	47.24	1.888	8957	.4310E-01	.1788E-02	23.46	21.37
F	49.48	1.949	7887	.7197E-01	.2833E-02	24.15	21.96
F	51.96	2.030	7837	.4811E-01	.1979E-02	24.61	22.40
F	52.32	2.080	7856	.1123E+00	.4423E-02	25.20	22.93
F	55.24	2.175	7882	.1158E+00	.4167E-02	25.87	23.94
F	56.51	2.225	7894	.1397E+00	.5908E-02	26.38	23.94
F	57.91	2.280	7184	.4529E+00	.3798E-01	26.84	24.68
F	59.82	2.355	7186	.2286E+01	.9088E-01	27.94	25.06
F	62.18	2.445	7187				

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FRACURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

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TABLE D1-45

SPECIMEN NUMBER: 27-1115
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: CAN AIN
TEST TEMPERATURE: 68-80 F
SPECIMEN THICKNESS: 1.54 MM (0.061 IN)
MAXIMUM STRESS: 117.2 MPa (17.0 KSI)
FREQUENCY: 200 CPS
CYCLES TO FAILURE: 2623 CYCLES
(MIN) 1917 CYCLES PRIOR TO FAILURE 41.41 MPa SQRTH (I) 37.68 KSI SQRTH (I)

CRACK LENGTH MM	IN	CYCLES	DELTA (A)/DELTA (H) MM/CYCLE	IN/CYCLE	DELTA (STRESS MPa SQRTH (I))	INTENSITY KSI SQRTH (I))
2.71	.107	1	.1220E-03	.4809E-05	10.89	9.91
3.30	.133	5454	.2226E-03	.8762E-05	11.99	10.92
4.00	.158	8273	.3367E-03	.1326E-04	13.04	11.87
4.72	.186	10309	.3988E-03	.1567E-04	14.06	12.79
5.42	.213	12144	.5802E-03	.2316E-04	15.07	13.71
6.22	.249	13513	.5849E-03	.2317E-04	16.08	14.56
6.89	.271	14648	.7720E-03	.3042E-04	16.76	15.25
7.49	.295	15425	.7132E-03	.2808E-04	17.47	15.90
8.13	.320	16326	.1093E-02	.4306E-04	18.49	16.83
9.36	.368	17446	.1517E-02	.5971E-04	19.41	17.66
9.89	.389	17796	.1270E-02	.5088E-04	20.02	18.22
10.57	.416	18333	.1149E-02	.4522E-04	20.54	18.69
11.96	.432	18675	.1396E-02	.5498E-04	21.05	19.16
11.63	.458	19157	.2013E-02	.7919E-04	21.62	19.68
12.10	.480	19428	.1859E-02	.7239E-04	22.18	20.18
12.85	.506	19792	.2229E-02	.8774E-04	22.73	20.68
13.42	.528	20049	.2170E-02	.8542E-04	23.30	21.21
14.17	.558	20392	.2351E-02	.9257E-04	23.87	21.72
14.75	.581	20641	.3183E-02	.1253E-03	24.34	22.15
15.29	.602	20809	.2745E-02	.1081E-03	24.86	22.63
16.02	.631	21076	.3172E-02	.1249E-03	25.40	23.11
16.61	.656	21261	.2841E-02	.1110E-03	25.82	23.50
17.10	.673	21434	.3307E-02	.1333E-03	26.28	23.92
17.78	.700	21638				
18.37	.723	21839	.3379E-02	.1338E-03	26.70	24.37
19.53	.769	22161	.4881E-02	.1975E-03	27.44	24.97
20.70	.818	22397	.4213E-02	.1659E-03	28.34	25.79
22.04	.868	22691	.4205E-02	.1607E-03	29.25	26.62
23.19	.913	22933	.4889E-02	.1893E-03	30.11	27.48
25.59	1.008	23350	.4614E-02	.1718E-03	31.34	28.92
26.97	1.062	23545	.6675E-02	.2628E-03	32.63	29.69
28.16	1.109	23730	.4952E-02	.2737E-03	33.49	30.47
29.22	1.150	23877	.7483E-02	.2946E-03	34.22	31.14
31.47	1.280	24827	.8365E-02	.3293E-03	34.97	31.82
31.57	1.245	24859	.8717E-02	.3432E-03	35.74	32.82
32.11	1.266	24209	.8881E-02	.3458E-03	36.44	33.16
33.76	1.329	24416	.8658E-02	.3486E-03	37.11	33.77
34.78	1.369	24916	.1017E-01	.4085E-03	37.78	34.38
35.88	1.413	24816	.1106E-01	.4345E-03	38.44	34.98
36.78	1.448	24714	.9123E-02	.3592E-03	39.86	35.55

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TABLE D1-46

SPECIMEN NUMBER: 2124-T861						
ALLOY TYPE: 2124-T861						
SPECIMEN ORIENTATION: LONGITUDINAL						
CONSTRAINT: STIFFENED						
ENVIRONMENT: LAB AIR						
TEST TEMPERATURE: 120° F						
SPECIMEN THICKNESS: 1.63 MM (.064 IN)						
MAXIMUM STRESS: 195.0 MPA (28.4 KSI)						
FREQUENCY: 280 CPM						
CYCLES TO FAILURE: 364 CYCLES						
K(MAX): 2 CYCLES PRIOR TO FAILURE: 93.72 MPA SQRT(MI) 85.29 KSI SQRT(IN)						
CRACK LENGTH	IN	CYCLES	DELTA (A)/DELTA (H)	DELTA (STRESS INTENSITY)	DELTA (STRESS INTENSITY)	DELTA (STRESS INTENSITY)
MM			MM/CYCLE	MPA SQRT(MI)	KSI SQRT(IN)	
2.75	.108	1	.129E-02	.4742E-04	18.62	18.40
3.22	.127	389	.1497E-02	.5853E-04	19.67	19.90
3.90	.153	845	.1939E-02	.7633E-04	21.44	19.51
4.55	.179	1183	.2681E-02	.1094E-03	23.18	21.39
5.32	.210	1467	.3354E-02	.1320E-03	24.74	22.51
5.92	.233	1644	.3749E-02	.1492E-03	26.13	23.78
6.41	.250	1829	.4591E-02	.1807E-03	27.40	24.94
7.17	.282	1951	.4571E-02	.1799E-03	28.65	26.27
7.49	.291	2129	.5029E-02	.2295E-03	29.96	27.27
8.57	.337	2225	.6469E-02	.2547E-03	31.20	28.39
9.25	.365	2332	.7666E-02	.3014E-03	32.53	29.60
10.11	.399	2442	.7704E-02	.3034E-03	33.84	30.84
10.90	.429	2545	.8732E-02	.3426E-03	35.14	31.98
11.66	.459	2631	.9094E-02	.3576E-03	36.34	33.07
12.44	.490	2718	.1013E-01	.3947E-03	37.50	34.13
13.21	.520	2734	.1304E-01	.5134E-03	38.71	35.23
14.03	.554	2861	.1474E-01	.5821E-03	39.90	36.31
14.86	.585	2914	.1854E-01	.7316E-03	41.04	37.18
15.77	.621	2963	.1743E-01	.7021E-03	42.20	38.47
16.62	.655	3011	.2145E-01	.8444E-03	43.36	39.46
17.41	.685	3047	.2337E-01	.9043E-03	44.40	40.41
18.23	.718	3083	.2781E-01	.1049E-02	45.47	41.38
19.07	.751	3113	.2726E-01	.1073E-02	46.44	42.01
20.74	.817	3175				
21.46	.845	3223	.1564E-01	.6178E-03	48.91	44.14
23.59	.929	3253	.7047E-01	.2790E-02	50.19	45.40
25.14	.991	3275	.6213E-01	.2446E-02	52.33	47.62
26.95	1.057	3312	.4636E-01	.1814E-02	54.18	49.31
28.58	1.125	3334	.6648E-01	.2621E-02	56.09	51.04
30.78	1.212	3369	.7116E-01	.2832E-02	58.24	53.00
31.91	1.246	3381	.9366E-01	.3447E-02	60.02	54.82
32.97	1.298	3393	.5315E-01	.2892E-02	61.18	55.68
34.02	1.371	3396	.1423E-01	.5684E-02	62.72	57.38
36.11	1.422	3432	.2144E-01	.8458E-02	64.36	58.57
37.56	1.479	3438	.2411E-01	.9492E-02	65.78	59.86
39.06	1.538	3434	.2508E-01	.9875E-02	67.30	61.25
40.06	1.613	3423	.2114E-01	.8322E-02	69.05	62.84
42.44	1.675	3429	.2004E-01	.8137E-02	70.84	64.46
44.65	1.758	3434	.4214E-01	.1459E-01	72.72	66.18
46.37	1.825	3439	.3429E-01	.1355E-01	74.68	67.96
48.75	1.919	3445	.3973E-01	.1564E-01	76.79	69.88
51.42	2.025	3453	.5344E-01	.2184E-01	79.40	72.26
54.44	2.143	3454	.7544E-01	.2978E-01	82.37	74.96
59.18	2.333	3459	.9682E-01	.3733E-01	86.48	74.78

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FRACTURE MECHANICS DATA FOR
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TABLE D1-47

SPECIMEN NUMBER: 62-STAT							
ALLOY: 2024-T861							
SPECIMEN ORIENTATION: T861-T851							
CONSTRAINT: 1							
TEST TECHNIQUE: 1							
SPECIMEN THICKNESS: 1							
MAXIMUM STRESS: 117.2 MPA (17.0 KSI)							
CYCLES TO FAILURE: 24000							
(MAX) 638 CYCLES PRIOR TO FAILURE 44.86 MPA SQRT(M) (48.18 KSI SQRT(IN))							
CRACK LENGTH	MM	IN	CYCLES	DELTA (A)/DELTA (H)	DELTA (STRESS INTENSITY)	DELTA (STRESS INTENSITY)	
				MM/CYCLE	MPA SQRT(M)	KSI SQRT(IN)	
3.13	.123		1	.1404E-03	.5842E-05	11.56	10.92
3.73	.147		4032	.1329E-03	.5234E-05	12.39	11.20
4.15	.163		7213	.1358E-03	.1301E-04	13.29	12.10
4.91	.193		9305	.1269E-03	.1062E-04	14.25	12.97
5.50	.217		11970	.14739E-03	.1066E-04	15.12	13.76
6.21	.244		13060	.1607E-03	.2365E-04	15.97	14.54
6.66	.270		14193	.1688E-03	.2709E-04	16.82	15.31
7.62	.300		15253	.1745E-03	.2933E-04	17.63	16.05
8.29	.326		16140	.1053E-02	.4144E-04	18.51	16.67
8.86	.349		16897	.1044E-02	.4124E-04	18.99	17.28
9.56	.377		17365	.1548E-02	.6093E-04	19.71	17.94
10.20	.405		17827	.1341E-02	.5249E-04	20.34	18.51
10.44	.427		18242	.2019E-02	.7947E-04	20.96	19.07
11.56	.455		18680	.1841E-02	.7266E-04	21.64	19.69
12.28	.484		18994	.2104E-02	.8990E-04	22.32	20.31
13.05	.514		19347	.3159E-02	.1244E-03	22.88	20.82
13.55	.534		19585	.2619E-02	.1038E-03	23.42	21.31
14.30	.563		19791	.3091E-02	.1217E-03	24.03	21.87
15.00	.591		20017	.2941E-02	.1158E-03	24.61	22.39
15.68	.617		20240	.3477E-02	.1369E-03	25.23	22.96
16.53	.651		20492	.3602E-02	.1418E-03	25.93	23.59
17.43	.686		20742	.4272E-02	.1602E-03	26.61	24.21
18.27	.719		20940	.4263E-02	.1678E-03	27.23	24.78
19.06	.751		21125	.5624E-02	.2214E-03	28.04	25.52
20.43	.804		21368	.5940E-02	.2181E-03	28.96	26.36
21.50	.849		21575	.5637E-02	.2219E-03	29.90	27.21
23.05	.908		21837	.7993E-02	.2909E-03	30.91	28.13
24.47	.963		22023	.7776E-02	.3061E-03	31.96	29.08
26.11	1.028		22235	.6092E-02	.3908E-03	33.50	30.56
29.31	1.154		22595	.1114E-01	.4306E-03	35.12	31.96
30.83	1.214		22731	.1201E-01	.5045E-03	36.10	32.65
32.39	1.275		22893	.1355E-01	.5333E-03	37.11	33.77
34.02	1.339		22973	.1474E-01	.5804E-03	38.25	34.81
36.61	1.416		23108	.1559E-01	.6137E-03	39.32	35.79
37.44	1.476		23203	.1726E-01	.6797E-03	40.27	36.65
39.04	1.538		23294	.1457E-01	.7309E-03	41.51	37.59
40.86	1.609		23391				

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TABLE D1-48

SPECIMEN INFORMATION						
SPECIMEN NUMBER: 62-171 ALLOY TYPE: 2024-T861 SPECIMEN ORIENTATION: TRANSVERSE CONSTRAINTS: STRESS ENVIRONMENT: AIR TEST TEMPERATURE: 68°F SPECIMEN THICKNESS: 1.63 MM (1/16 IN) MAXIMUM STRESS: 195.8 MPa (28.4 KSI) FREQUENCY: 200 CPM CYCLES TO FAILURE: 2817 4 CYCLES PRIOR TO FAILURE: 68.98 MPa SQRT(IN) (55.49 KSI SQRT(IN))						
CRACK LENGTH MM IN	CYCLES	DELTA (A)/DELTA (H) MM/CYCLE IN/CYCLE	DELTA (STRESS INTENSITY) MPa SQRT(IN) KSI SQRT(IN)	DELTA (STRESS INTENSITY) MPa SQRT(IN) KSI SQRT(IN)	DELTA (STRESS INTENSITY) MPa SQRT(IN) KSI SQRT(IN)	DELTA (STRESS INTENSITY) MPa SQRT(IN) KSI SQRT(IN)
3.21	126	.2321E-02	.9136E-04	19.05	18.06	
4.03	159	.3999E-02	.1574E-03	21.03	19.67	
4.73	166	.4244E-02	.1671E-03	23.01	21.00	
5.43	214	.5786E-02	.2278E-03	25.22	22.96	
6.26	246	.7274E-02	.2884E-03	26.94	24.91	
7.06	278	.8437E-02	.2534E-03	28.84	26.24	
8.19	323	.7881E-02	.2993E-03	30.36	27.63	
8.78	343	.1089E-01	.3973E-03	32.13	29.24	
10.21	402	.1093E-01	.4384E-03	34.67	31.05	
11.77	463	.2140E-01	.8456E-03	38.47	33.19	
12.98	492	.1488E-01	.5935E-03	37.47	34.18	
13.18	516	.1714E-01	.6769E-03	38.41	36.06	
13.77	542	.1822E-01	.7179E-03	39.42	36.07	
14.98	571	.1889E-01	.7438E-03	40.45	38.01	
15.24	600	.2071E-01	.8158E-03	41.93	37.08	
16.07	633	.2216E-01	.8726E-03	42.95	38.73	
16.76	668	.2578E-01	.1015E-02	43.97	39.65	
17.61	693	.6587E-01	.2568E-02	45.00	40.96	
18.07	747	.2201E-01	.8979E-03	46.21	42.86	
19.52	769	.2499E-01	.9037E-03	47.17	42.92	
20.92	888	.3371E-01	.1327E-02	48.58	44.14	
21.70	854	.4078E-01	.1029E-02	50.07	45.97	
23.15	911	.9234E-01	.2861E-02	51.77	47.11	
24.61	969	.7874E-01	.3188E-02	53.55	48.73	
26.27	1034	.9932E-01	.3792E-02	55.49	50.50	
28.08	1105	.1028E+00	.4015E-02	57.21	52.06	

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TABLE D1-49

SPECIMEN NUMBER: TEST TYPE: SPECIMEN ORIENTATION: CONSTRAINT: ENVIRONMENT: TEST TECHNIQUE: SPECIMEN THICKNESS: MAXIMUM STRESS: FREQUENCY: R-RATIO: CYCLES TO FAILURE: K(MAX) 10 CYCLES PRIOR TO FAILURE:						
			63-111 2024-T861 117.2 NPA (17.0 KSI) 11.54 MM (0.45 IN) 78970 CYCLES 280 MPa 88.15 NPA SQRT(IN) (72.94 KSI SQRT(IN))			
CRACK LENGTH MM	IN	CYCLES	DELTA (A1/DELTA IN) MM/CYCLE	IN/CYCLE	DELTA STRESS NPA SQRT(IN)	INTENSITY KSI SQRT(IN)
3.16	.124		.6360E-04	.2907E-05	6.10	5.62
3.98	.154	11660	.8289E-04	.3264E-05	6.81	6.28
4.68	.184	21629	.1184E-03	.4661E-05	7.38	6.72
5.41	.213	27135	.1225E-03	.4822E-05	7.88	7.17
6.17	.239	32547	.1542E-03	.6889E-05	8.30	7.55
6.67	.263	36885	.1839E-03	.7241E-05	8.72	7.93
7.37	.288	48283	.1984E-03	.7811E-05	9.11	8.29
7.98	.314	43333	.2149E-03	.8499E-05	9.45	8.68
8.53	.336	45907	.2517E-03	.9988E-05	9.86	8.97
9.41	.370	49399	.2963E-03	.1167E-04	10.29	9.36
10.11	.398	51752	.3829E-03	.1507E-04	10.71	9.74
11.01	.434	54117	.4213E-03	.1660E-04	11.14	10.13
11.81	.469	56815	.4433E-03	.1749E-04	11.49	10.45
12.45	.488	57456	.4995E-03	.1991E-04	11.88	10.74
13.14	.518	58839	.5597E-03	.2284E-04	12.13	11.04
13.84	.545	68105	.7696E-03	.3838E-04	12.44	11.32
14.54	.572	61867	.8423E-03	.2529E-04	12.74	11.59
15.18	.597	62036	.8191E-03	.3229E-04	13.82	11.85
15.82	.623	62787	.8923E-03	.3512E-04	13.26	12.39
16.42	.648	63453	.8967E-03	.3928E-04	13.53	12.31
16.99	.669	64094	.1228E-02	.4836E-04	13.79	12.55
17.86	.695	64661	.1153E-02	.4929E-04	14.85	12.79
18.27	.719	65174	.1283E-02	.4863E-04	14.25	12.97
18.65	.734	65927				
20.02	.788	68884	.1178E-02	.4837E-04	14.40	13.28
21.81	.859	68853	.1314E-02	.5172E-04	15.21	13.84
23.21	.914	69021	.1427E-02	.5619E-04	15.81	14.39
24.60	.969	69715	.2033E-02	.8886E-04	16.32	14.85
26.02	1.024	70435	.1961E-02	.7722E-04	16.83	15.31
27.25	1.073	71054	.1988E-02	.7625E-04	17.30	15.74
28.62	1.127	71619	.2443E-02	.9617E-04	17.75	16.15
29.94	1.179	72134	.2696E-02	.1041E-03	18.21	16.57
31.35	1.234	72628	.2709E-02	.1888E-03	18.67	16.98
32.93	1.296	73111	.3266E-02	.1286E-03	19.18	17.45
34.34	1.352	73591	.2947E-02	.1168E-03	19.67	17.38
35.75	1.408	74312	.3348E-02	.1318E-03	20.14	18.33
37.09	1.463	74336	.4135E-02	.1628E-03	20.59	18.74
38.38	1.510	74663	.4173E-02	.1643E-03	21.81	19.12
39.78	1.546	74981	.4193E-02	.1635E-03	21.45	19.52
41.14	1.608	75257	.4924E-02	.1938E-03	21.90	19.93
42.35	1.667	75514	.4837E-02	.1984E-03	22.31	20.31
43.85	1.727	75761	.5978E-02	.2338E-03	22.75	20.71
44.98	1.771	75986	.5812E-02	.1973E-03	23.18	21.09
46.21	1.819	76163	.6967E-02	.2743E-03	23.56	21.44
47.33	1.863	76353	.5855E-02	.2389E-03	23.94	21.78
F	49.40	1.945	.9229E-02	.3633E-03	24.45	22.25
F	50.93	2.085	.6394E-02	.1714E-03	25.84	22.79
F	53.09	2.098	.8636E-02	.3488E-03	29.65	23.34
F	56.26	2.215	.1273E-01	.9888E-03	26.53	24.14
F	58.84	2.285	.8890E-02	.3588E-03	27.36	24.98
F	61.72	2.430	.1842E-01	.7258E-03	28.38	25.75
F	64.39	2.535	.1333E-01	.5258E-03	29.41	26.76
F	65.91	2.595	.1816E-01	.4888E-03	38.16	27.45
F	67.18	2.648	.1278E-01	.5888E-03	38.67	27.91
F	69.69	2.728	.1485E-01	.7588E-03	31.26	28.44
F	71.25	2.885	.3886E-01	.1214E-02	32.82	29.14
			.1889E-01	.4286E-03	32.59	29.66

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F	72.81	2.835	78914	.1996E-01	.7887E-03	33.81	38.84
F	73.41	2.890	78908	.3266E-01	.1296E-02	33.75	38.71
F	75.69	2.908	78950	.3179E-01	.1298E-02	34.61	31.49
F	77.69	3.055	78718	.2328E-01	.9167E-03	35.38	32.73
F	78.99	3.118	78778	.9396E-01	.2188E-02	36.19	32.93
F	81.66	3.215	78828	.2794E-01	.1188E-02	37.18	33.76
F	83.08	3.278	78878	.2286E-01	.9888E-03	37.69	34.38
F	86.28	3.315	78928	.7628E-01	.3888E-02	38.23	34.79
F	89.34	3.388	78963	.6988E-01	.2798E-02	38.84	35.34
F	88.74	3.415	78963	.3998E-01	.1488E-01	39.62	36.86
F	88.52	3.405	78968				

TABLE D1-50

SPECIMEN NUMBER		TEST TYPE		SPECIMEN SIZE		FREQUENCY		CYCLES TO FAILURE		NET STRESS GREATER THAN 1.0 MPa	
MM	IN	MM	IN	MM	IN	KHZ	Hz	KMPa	MPa	KMPa	MPa
3.13	.123	1004	.3918E-03	.1296E-04	10.10	9.27					
3.76	.148	1064	.3727E-03	.1467E-04	11.11	10.11					
4.44	.175	1794	.9274E-03	.2116E-04	11.96	10.88					
5.08	.199	4926	.8766E-03	.2871E-04	12.98	11.74					
5.98	.235	6382	.8631E-03	.3819E-04	13.77	12.93					
6.99	.279	7819	.1085E-02	.4272E-04	14.69	12.19					
7.32	.288	7699	.1962E-02	.7726E-04	15.14	13.77					
7.85	.309	7965	.2193E-02	.8621E-04	15.72	14.31					
8.51	.335	8266	.2379E-02	.9388E-04	16.32	14.85					
9.11	.359	8519	.2378E-02	.9174E-04	16.96	15.43					
9.96	.396	8888	.2538E-02	.9988E-04	17.66	16.07					
10.70	.421	9174	.1964E-02	.7733E-04	18.28	16.61					
11.25	.444	9674	.4768E-02	.1869E-03	18.84	17.14					
12.18	.477	9666	.4257E-02	.1676E-03	19.42	17.67					
12.72	.501	9791	.4988E-02	.1956E-03	19.94	18.19					
13.45	.530	9938	.3833E-02	.1419E-03	20.45	18.61					
14.85	.593	10134	.4687E-02	.1739E-03	20.96	19.07					
14.79	.582	10272	.4869E-02	.1919E-03	21.45	19.92					
15.39	.606	10395	.4393E-02	.1738E-03	21.88	19.91					
15.94	.629	10938	.7324E-02	.2884E-03	22.39	20.38					
16.83	.663	10846	.6218E-02	.2445E-03	22.90	20.92					
17.68	.696	10782	.4925E-02	.1939E-03	23.46	21.35					
18.26	.718	10897	.6424E-02	.2538E-03	23.87	21.72					
19.88	.783	16997									

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TABLE D1-11

SPECIMEN NUMBER: U63-BL3			
ALLOY TYPE: 2024-T861			
SPECIMEN ORIENTATION: LONGITUDINAL			
CONSTRAINT: UNSTIFFENED			
ENVIRONMENT: NITROGEN			
TEST TEMPERATURE: 144.4 K			
SPECIMEN THICKNESS: 1.65 MM (1.062 IN)			
MAXIMUM STRESS: 169.25 MPA (24.5 KSI)			
R-RATIO: .05			
FREQUENCY: 200 CPM			
CYCLES TO FAILURE: 3620 CYCLES			
K(MAX): 135 CYCLES PRIOR TO FAILURE: 40.83 MPA SQRT(IN) 37.15 KSI SQRT(IN))			

CRACK LENGTH IN	CYCLES	DELTA(A)/DELTA(IN) MM/CYCLE	DELTA(STRESS INTENSITY) MPA SQRT(IN)	DELTA(STRESS INTENSITY) KSI SQRT(IN)	
.171	1	.0884E-03	.3498E-04	19.56	17.40
.201	873	.1337E-02	.5263E-04	21.15	19.24
.233	1481	.2104E-02	.8289E-04	22.46	20.90
.279	2029	.3118E-02	.1228E-03	24.73	22.50
.314	2321	.3777E-02	.1487E-03	26.26	23.90
.354	2587	.5357E-02	.2189E-03	27.86	25.36
.397	2793	.6409E-02	.2523E-03	29.54	26.88
.446	2986	.7295E-02	.2872E-03	31.05	28.25
.494	3119	.1049E-01	.4132E-03	32.34	29.43
.523	3214	.1284E-01	.5354E-03	33.67	30.55
.561	3284	.1733E-01	.6824E-03	34.87	31.73
.607	3356	.1817E-01	.7154E-03	36.13	32.88
.645	3404	.1995E-01	.7857E-03	37.40	34.33
.694	3471	.4363E-01	.1718E-02	38.45	34.99
.718	3485				

TABLE D1-12

SPECIMEN NUMBER: U63-BT9			
ALLOY TYPE: 2024-T861			
SPECIMEN ORIENTATION: TRANSVERSE			
CONSTRAINT: UNSTIFFENED			
ENVIRONMENT: NITROGEN			
TEST TEMPERATURE: 144.4 K			
SPECIMEN THICKNESS: 1.66 MM (1.053 IN)			
MAXIMUM STRESS: 164.9 MPA (23.9 KSI)			
R-RATIO: .05			
FREQUENCY: 200 CPM			
CYCLES TO FAILURE: 1383 CYCLES			
K(MAX): 118 CYCLES PRIOR TO FAILURE: 32.12 MPA SQRT(IN) (29.23 KSI SQRT(IN))			

CRACK LENGTH MM IN	CYCLES	DELTA (A)/DELTA (IN) MM/CYCLE IN/CYCLE	DELTA (STRESS INTENSITY) MPA SQRT(IN) KSI SQRT(IN)		
4.70 .185	1	.1986E-02	.7589E-04	28.81	18.21
5.68 .224	516	.3561E-02	.1482E-03	21.84	19.88
6.68 .263	796	.9463E-02	.2151E-03	23.34	21.24
7.42 .292	932	.8943E-02	.3521E-03	24.64	22.42
8.28 .326	1828	.9039E-02	.3599E-03	26.18	23.83
9.44 .371	1156	.1778E-01	.7880E-03	27.84	25.34
10.57 .416	1220	.3138E-01	.1236E-02	29.59	26.93
11.99 .472	1265				

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TABLE D1-13

SPECIMEN NUMBER: ALLOY TYPE: SPECIMEN ORIENTATION: CONSTRAINT: ENVIRONMENT: TEST TEMPERATURE: SPECIMEN THICKNESS: MAXIMUM STRESS: R-RATIO: FREQUENCY: CYCLES TO FAILURE: K(MAX) 1 CYCLES PRIOR TO FAILURE:						
103-676 2024-T861 TRANSVERSE UNSTIFFENED NITROGEN 144°F 1.65 MM (0.065 IN) 110.6 MPA (17.2 KSI) 288 CPM 3083 CYCLES 51.60 MPA SQR(T IN) (46.96 KSI SQR(T IN))						
CRACK LENGTH MM	CRACK LENGTH IN	CYCLES	DELTA(A)/DELTA(N) MM/CYCLE	DELTA(A)/DELTA(N) IN/CYCLE	DELTA(Stress Intensity) MPa SQR(T IN)	DELTA(Stress Intensity) KSI SQR(T IN)
8.47	.333	1	.1300E-02	.5116E-04	18.03	17.14
9.25	.364	602	.2051E-02	.8076E-04	19.05	18.07
10.41	.410	1171	.2761E-02	.1087E-03	20.94	19.05
11.43	.450	1539	.3477E-02	.1369E-03	21.94	19.97
12.52	.493	1852	.4390E-02	.1720E-03	22.92	20.86
13.58	.535	2093	.6591E-02	.2595E-03	23.01	21.67
14.55	.573	2241	.6768E-02	.2665E-03	24.70	22.40
15.66	.617	2405	.9267E-02	.3648E-03	25.61	23.31
16.76	.660	2523	.1157E-01	.4554E-03	26.56	24.17
18.64	.710	2634	.1244E-01	.4896E-03	27.55	25.07
19.30	.760	2735	.1960E-01	.7750E-03	28.30	25.75
20.00	.788	2771	.2236E-01	.8803E-03	29.15	26.53
21.59	.850	2842	.2165E-01	.8524E-03	30.05	27.35
F 22.40	.885	2881	.2963E-01	.1167E-02	30.60	27.92
F 23.37	.920	2913	.3556E-01	.1400E-02	31.31	28.49
F 24.26	.955	2934	.6096E-01	.2400E-02	32.15	29.25
F 25.78	1.015	2963	.3810E-01	.1500E-02	32.93	29.97
F 26.54	1.045	2983	.5715E-01	.2250E-02	33.57	30.55
F 27.69	1.090	3003	.5000E-01	.2000E-02	34.29	31.21
F 28.70	1.130	3023	.8255E-01	.3250E-02	35.17	32.01
F 30.35	1.195	3043	.1651E+00	.6500E-02	36.24	32.90
F 32.00	1.260	3053	.1524E+00	.6000E-02	37.02	33.69
F 32.77	1.290	3054	.4064E+00	.1600E-01	37.91	34.50
F 34.80	1.370	3063	.3811E+00	.1500E-01	39.16	35.63
F 36.70	1.445	3069	.7303E+00	.2877E-01	40.67	37.01
F 39.62	1.560	3072	.2540E+00	.1000E-01	41.81	38.05
F 40.39	1.590	3075	.8890E+00	.3500E-01	42.60	38.77
F 42.16	1.660	3077	.1016E+01	.4000E-01	43.47	39.56
F 43.10	1.700	3078	.2286E+01	.9000E-01	44.49	40.49
F 45.47	1.790	3079	.2032E+01	.8000E-01	45.83	41.71
F 47.50	1.870	3080	.1995E+01	.7500E-01	47.06	42.83
F 49.40	1.945	3081	.2159E+01	.8500E-01	48.34	43.99
F 51.56	2.030	3082				

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TABLE D1-14

SPECIMEN NUMBER: 63-811 ALLOY TYPE: 2024-T861 SPECIMEN ORIENTATION: LONGITUDINAL CONSTRAINT: STIFFENED ENVIRONMENT: ARGON TEST TEMPERATURE: 322 °F SPECIMEN THICKNESS: 1.64 MM (0.0646 IN) MAXIMUM STRESS: 75.2 MPA (10.9 KSI) FREQUENCY: 280 CPS CYCLES TO FAILURE: 94999 CYCLES K(MAX) 3 CYCLES PRIOR TO FAILURE: 56.03 MPA SQRT(M) (50.99 KSI SQRT(IN))						
CRACK LENGTH MM	IN	CYCLE	DELTA (A)/DELTA (H) MM/CYCLE	IN/CYCLE	DELTA (STRESS INTENSITY) MPA SQRT(M)	KSI SQRT(IN)
7.35	.289	20001	.9372E-04	.3690E-05	11.07	10.07
7.89	.310	25733	.7102E-04	.2796E-05	11.47	13.44
8.47	.334	33977	.1154E-03	.4544E-05	11.89	10.82
9.10	.358	39380	.1061E-03	.4175E-05	12.30	11.19
9.70	.382	45080	.1536E-03	.6047E-05	12.71	11.57
11.37	.488	49421	.1391E-03	.5478E-05	13.11	11.93
10.96	.431	53656	.1958E-03	.7704E-05	13.50	12.28
11.62	.457	57029	.2136E-03	.8408E-05	13.92	12.67
12.38	.487	60591	.2441E-03	.9608E-05	14.30	13.02
12.94	.509	62886	.2227E-03	.8767E-05	14.80	13.29
13.42	.528	65036	.3407E-03	.1341E-04	14.90	13.56
14.01	.552	66788	.3019E-03	.1189E-04	15.23	13.86
14.62	.576	68807	.3894E-03	.1454E-04	15.54	14.15
15.16	.597	70268	.4492E-03	.1768E-04	15.91	14.48
16.02	.631	72168	.6017E-03	.2369E-04	16.29	14.82
16.60	.654	73141	.4284E-03	.1687E-04	16.62	15.13
17.35	.683	74881	.6284E-03	.2474E-04	16.95	15.42
17.89	.704	75742	.6118E-03	.2409E-04	17.30	15.74
18.76	.739	77166	.7355E-03	.2895E-04	17.63	16.05
19.28	.759	77874	.7659E-03	.3016E-04	18.09	16.46
20.66	.813	79678	.9276E-03	.3652E-04	18.66	17.00
21.80	.858	80982	.1103E-02	.4343E-04	19.29	17.56
23.34	.919	82303	.1317E-02	.5107E-04	19.90	18.11
24.54	.966	83214				
25.93	1.021	84295	.1284E-02	.5056E-04	20.47	18.63
27.26	1.073	85063	.1736E-02	.6836E-04	21.04	19.16
28.52	1.123	85749	.1833E-02	.7216E-04	21.61	19.67
29.90	1.177	86445	.1985E-02	.7815E-04	22.16	20.17
31.31	1.233	87112	.2113E-02	.8321E-04	22.74	20.69
32.51	1.281	87663	.2229E-02	.8777E-04	23.28	21.18
33.95	1.337	88175	.2745E-02	.1081E-03	23.81	21.67
35.30	1.390	88614	.3084E-02	.1214E-03	24.37	22.18
36.71	1.445	89093	.2938E-02	.1157E-03	24.92	22.68
37.81	1.488	89402	.3547E-02	.1396E-03	25.42	23.13
39.28	1.546	89833	.3424E-02	.1348E-03	25.93	23.60
40.67	1.601	90280	.3111E-02	.1225E-03	26.49	24.11
42.08	1.657	90607	.4295E-02	.1691E-03	27.04	24.61
43.49	1.712	90911	.4646E-02	.1829E-03	27.60	25.12
44.68	1.759	91161	.4765E-02	.1876E-03	28.11	25.58
45.85	1.805	91387	.5159E-02	.2031E-03	28.57	26.00
47.26	1.861	91666	.5888E-02	.2200E-03	29.08	26.47
48.70	1.918	91907	.5981E-02	.2355E-03	29.65	26.98
50.10	1.972	92146	.5824E-02	.2293E-03	30.21	27.49
51.29	2.019	92332	.6425E-02	.2533E-03	30.72	27.96
52.65	2.073	92524	.7071E-02	.2784E-03	31.23	28.42
53.74	2.116	92664	.7783E-02	.3084E-03	31.72	28.87
54.93	2.162	92833	.7034E-02	.2769E-03	32.19	29.29
56.26	2.215	92989	.8516E-02	.3353E-03	32.70	29.76
57.70	2.272	93140	.9580E-02	.3772E-03	33.27	30.27
59.05	2.325	93304	.8201E-02	.3229E-03	33.84	30.80
60.27	2.373	93453	.8183E-02	.3221E-03	34.38	31.29
61.44	2.419	93567	.8033E-02	.3066E-03	34.89	31.75
62.84	2.474	93685	.1182E-01	.4653E-03	35.43	32.25
64.13	2.525	93797	.1150E-01	.4527E-03	36.01	32.77
65.73	2.588	93914	.1373E-01	.5406E-03	36.64	33.35
67.18	2.645	94038	.1247E-01	.4999E-03	37.32	33.96
			.1508E-01	.5937E-03	38.00	34.58

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	68.73	2.786	94133	.1548E-01	.6893E-03	38.67	35.28
	70.14	2.761	94224	.1453E-01	.5719E-03	39.33	35.80
	71.56	2.817	94322	.1549E-01	.6099E-03	39.93	36.34
	72.86	2.861	94393	.2171E-01	.8548E-03	40.92	36.87
	74.01	2.914	94455	.2474E-01	.9740E-03	41.16	37.46
	75.30	2.964	94507	.2504E-01	.9858E-03	42.58	38.75
F	79.63	3.135	94688	.2540E-01	.1000E-02	44.85	40.09
F	80.90	3.185	94730	.3556E-01	.1400E-02	44.88	41.84
F	82.68	3.255	94783	.3322E-01	.1300E-02	45.83	41.71
F	84.33	3.320	94830	.3302E-01	.1300E-02	46.78	42.57
F	85.98	3.385	94880	.4064E-01	.1600E-02	47.88	43.57
F	88.01	3.465	94930	.3266E-01	.1266E-02	48.85	44.46
F	89.15	3.518	94965	.1826E+00	.4038E-02	50.86	45.56
F	91.82	3.615	94991	.6032E+00	.2375E-01	51.76	47.18
F	94.23	3.710	94995	.8890E+00	.3500E-01	52.91	48.15
F	95.12	3.745	94996				

TABLE D1-15

SPECIMEN NUMBER: 63-219
 ALLOY TYPE: 2024-T861
 SPECIMEN ORIENTATION: LONGITUDINAL
 CONSTRAINT: STIFFENED
 ENVIRONMENT: AIRCON
 TEST TEMPERATURE: 302.0 K
 SPECIMEN THICKNESS: 1.81 MM (0.071 IN)
 MAXIMUM STRESS: 118.7 MPA (17.2 KSI)
 FREQUENCY: 200 CPM
 CYCLES TO FAILURE: 16328 CYCLES
 K(MAX) 1 CYCLES PRIOR TO FAILURE: 66.48 MPA SQRT(IN) (60.50 KSI SQRT(IN))

	CRACK LENGTH MM	IN	CYCLES	DELTA (A)/DELTA (H) MM/CYCLE	IN/CYCLE	DELTA (STRESS INTENSITY) MPA SQRT(IN)	INTENSITY KSI SQRT(IN)
	5.62	.221	1	.3125E-03	.1230E-04	15.41	14.03
	6.21	.244	1899	.3769E-03	.1484E-04	16.24	14.78
	6.91	.272	3766	.4270E-03	.1681E-04	17.17	15.62
	7.74	.305	5708	.6669E-03	.2626E-04	18.14	16.51
	8.62	.339	7022	.8265E-03	.3254E-04	18.91	17.21
	9.14	.360	7652	.8802E-03	.3465E-04	19.73	17.96
	10.18	.401	8838	.1448E-02	.5702E-04	20.72	18.86
	11.10	.437	9472	.1414E-02	.5566E-04	21.70	19.74
	12.20	.480	10250	.1368E-02	.5388E-04	22.54	20.51
	12.91	.508	10766	.2202E-02	.8679E-04	23.24	21.15
	13.77	.542	11157	.2203E-02	.8675E-04	24.05	21.89
	14.76	.581	11636	.2640E-02	.1039E-03	25.04	22.79
	16.10	.634	12114	.2622E-02	.1032E-03	26.00	23.66
	17.11	.674	12499	.3310E-02	.1303E-03	26.80	24.39
	18.09	.712	12796	.4223E-02	.1663E-03	27.52	25.05
	18.97	.747	13035	.4209E-02	.1657E-03	28.37	25.82
	20.31	.800	13323	.5115E-02	.2014E-03	29.48	26.83
	21.96	.865	13645	.5431E-02	.2138E-03	30.74	27.98
	23.81	.937	13985	.5906E-02	.2375E-03	31.90	29.11
	25.50	1.004	14271	.7271E-02	.2863E-03	33.20	30.21
	27.35	1.077	14526	.8574E-02	.3376E-03	34.38	31.28
	29.00	1.142	14719	.8884E-02	.3498E-03	35.56	32.36
	30.95	1.218	14938	.1169E-01	.4607E-03	36.75	33.44
	32.66	1.286	15084	.1164E-01	.4581E-03	37.74	34.14
	34.02	1.339	15231	.1481E-01	.5829E-03	38.72	35.24
	35.75	1.407	15318	.1248E-01	.4914E-03	39.86	36.28
	37.65	1.482	15470	.1574E-01	.6198E-03	40.90	37.30
	39.32	1.548	15576	.2023E-01	.7966E-03	42.06	38.28
	41.10	1.616	15664	.1781E-01	.7013E-03	43.05	39.17
	42.49	1.673	15742	.2398E-01	.9439E-03	43.97	40.02
F	44.07	1.735	15808	.2721E-01	.1071E-02	45.06	41.00
F	45.97	1.810	15878	.2359E-01	.9286E-03	46.16	42.01
F	47.62	1.875	15948	.2328E-01	.9167E-03	47.12	42.88
F	49.02	1.930	16008	.3810E-01	.1500E-02	48.15	43.82
F	50.93	2.005	16058	.3810E-01	.1500E-02	49.36	44.92
F	52.83	2.080	16138				

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F	54.10	2.130	16140	.3175E-01	.1250E-02	50.37	45.84
F	55.37	2.180	16183	.3629E-01	.1429E-02	51.10	46.90
F	57.20	2.255	16200	.7620E-01	.3001E-02	52.21	47.51
F	58.67	2.310	16233	.5580E-01	.2200E-02	53.29	48.49
F	60.50	2.385	16253	.9525E-01	.3750E-02	54.38	49.49
F	61.85	2.435	16268	.8467E-01	.3333E-02	55.44	50.45
F	63.12	2.485	16283	.8467E-01	.3333E-02	56.30	51.23
F	64.64	2.545	16293	.1524E+00	.6000E-02	57.25	52.10
F	66.00	2.630	16305	.1799E+00	.7003E-02	58.54	53.27
F	66.45	2.695	16314	.1834E+00	.7222E-02	59.89	54.50
F	69.90	2.755	16321	.2177E+00	.9571E-02	61.03	55.54
F	72.26	2.845	16327	.3010E+00	.1500E-01	62.44	56.82

TABLE D1-16

SPECIMEN NUMBER: 63-412
 ALLOY TYPE: 2024-T861
 SPECIMEN ORIENTATION: LONGITUDINAL
 CONSTRAINT: STIFFENED
 ENVIRONMENT: AIR
 TEST TEMPERATURE: 293.7 K
 SPECIMEN THICKNESS: 1.52 MM (.0600 IN)
 MAXIMUM STRESS: 244.4 MPA (35.4 KSI)
 R-RATIO: 1
 FREQUENCY: 200 CPM
 CYCLES TO FAILURE: 1637 CYCLES
 K(MAX) 214 CYCLES PRIOR TO FAILURE 48.10 MPA SORT(M) (43.77 KSI SORT(M))

CRACK LENGTH MM	IN	CYCLES	DELTA(K)/DELTA(M) MM/CYCLE	IN/CYCLE	DELTA(Stress Intensity) MPa SORT(M)	KSI SORT(M)
3.62	.143	1	.1931E-02	.7603E-04	25.94	23.61
4.33	.170	366	.3296E-02	.1290E-03	28.00	25.40
4.93	.194	549	.4624E-02	.1821E-03	30.03	27.33
5.72	.225	719	.3401E-02	.1339E-03	31.80	28.96
6.21	.245	865	.6094E-02	.2399E-03	33.36	30.36
6.91	.272	979	.6604E-02	.2600E-03	35.09	31.93
7.60	.299	1084	.1105E-01	.4349E-03	36.61	31.32
8.19	.322	1137	.9917E-02	.3904E-03	38.29	34.84
9.67	.357	1226	.9862E-02	.3883E-03	39.95	36.35
9.70	.382	1293	.1527E-01	.6010E-03	41.42	37.69
10.46	.412	1340	.1507E-01	.5933E-03	43.00	39.13
11.25	.443	1392	.3191E-01	.1256E-02	44.75	40.72
12.24	.482	1423				

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TABLE D1-17

SPECIMEN NUMBER: 63-578
ALLOY TYPE: 2124-T861
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINT: STRESS
ENVIRONMENT: ARGON
TEST TEMPERATURE: 303.2 K
SPECIMEN THICKNESS: 1.65 MM (0.065 IN)
MAXIMUM STRESS: 74.9 MPA (10.8 KSI)
R-RATIO: 0.5
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 66605 CYCLES
K(MAX) 51 CYCLES PRIOR TO FAILURE: 41.03 MPA SQRT(IN) (37.34 KSI SQRT(IN))

CRACK LENGTH MM	IN	CYCLES	DELTA(A)/DELTA(H) MM/CYCLE	IN/CYCLE	DELTA(Stress Intensity) MPA SQRT(IN)	KSI SQRT(IN)
7.49	.295	1	.7077E-04	.2786E-05	11.10	10.10
8.12	.320	8956	.1150E-03	.4529E-05	11.70	10.65
9.19	.362	18274	.1050E-03	.4136E-05	12.41	11.29
10.26	.404	28454	.2966E-03	.1168E-04	12.92	11.76
10.81	.426	30308	.1506E-03	.5930E-05	13.27	12.07
11.40	.449	34227	.2243E-03	.8832E-05	13.63	12.41
12.04	.474	37045	.3029E-03	.1192E-04	14.04	12.77
12.79	.503	39519	.2162E-03	.8511E-05	14.45	13.15
13.58	.531	42797	.3370E-03	.1327E-04	14.87	13.54
14.32	.564	45254	.3815E-03	.1502E-04	15.33	13.95
15.17	.597	47468	.4078E-03	.1606E-04	15.71	14.29
15.77	.621	48944	.4823E-03	.1899E-04	16.03	14.59
16.43	.647	50316	.5281E-03	.2079E-04	16.40	14.92
17.21	.677	51783	.5712E-03	.2249E-04	16.82	15.30
18.11	.713	53366	.7931E-03	.3122E-04	17.21	15.66
18.83	.741	54274	.8777E-03	.3175E-04	17.76	16.16
20.41	.804	56233	.1092E-02	.4300E-04	18.43	16.78
21.71	.855	57426	.1114E-02	.4385E-04	19.03	17.32
23.05	.937	58622	.1964E-02	.6156E-04	19.66	17.89
24.54	.966	59578	.1727E-02	.6881E-04	20.30	18.48
26.03	1.024	60422	.1880E-02	.7402E-04	20.92	19.04
27.44	1.080	61190	.2192E-02	.8629E-04	21.56	19.62
29.05	1.144	61923	.2777E-02	.1093E-03	22.18	20.19
30.43	1.198	62422				
32.02	1.261	62905	.3279E-02	.1291E-03	22.79	20.74
33.63	1.324	63341	.3688E-02	.1452E-03	23.43	21.32
35.33	1.391	63899	.4794E-02	.1872E-03	24.09	21.93
36.74	1.447	64076	.3759E-02	.1480E-03	24.71	22.49
38.29	1.507	64314	.6473E-02	.2548E-03	25.29	23.02
39.84	1.568	64584	.5743E-02	.2261E-03	25.90	23.57
41.40	1.630	64813	.6929E-02	.2728E-03	26.51	24.12
42.74	1.643	65007	.6814E-02	.2683E-03	27.07	24.64
44.14	1.738	65188	.7711E-02	.3036E-03	27.61	25.12
45.34	1.785	65311	.9757E-02	.3441E-03	28.11	25.58
46.81	1.843	65486	.8375E-02	.3297E-03	28.63	26.06
48.15	1.896	65801	.1171E-01	.4609E-03	29.18	26.56
49.71	1.957	65765	.9479E-02	.3732E-03	29.75	27.08
50.95	2.006	65864	.1253E-01	.4934E-03	30.30	27.58
53.09	2.090	66003	.1539E-01	.6058E-03	30.97	28.19
54.49	2.145	66069	.2163E-01	.8515E-03	31.68	28.83
56.33	2.218	66151	.2209E-01	.8699E-03	32.33	29.42
57.47	2.263	66211	.1909E-01	.7517E-03	32.94	29.97
59.16	2.129	66279	.2464E-01	.9779E-03	33.52	30.50
60.50	2.182	66334	.2434E-01	.9582E-03	34.14	31.07
62.05	2.443	66376	.3686E-01	.1451E-02	34.75	31.62
63.36	2.494	66414	.3446E-01	.1197E-02	35.36	32.18
65.78	2.590	66463	.4956E-01	.1951E-02	36.16	32.91
67.21	2.646	66484	.6779E-01	.2669E-02	37.01	33.68
68.89	2.712	66520	.4667E-01	.1837E-02	37.78	34.31
69.77	2.747	66535	.5884E-01	.2317E-02	38.28	34.84
70.29	2.767	66545	.5194E-01	.2045E-02	38.80	35.13
72.84	2.779	66555	.5512E-01	.2170E-02	38.85	35.35

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TABLE D1-18

SPECIMEN NUMBER: 63-372
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINT: STIFFENED
ENVIRONMENT: ARGON
TEST TEMPERATURE: 304.3 K
SPECIMEN THICKNESS: 1.65 MM (0.065 IN)
MAXIMUM STRESS: 118.6 MPA (17.2 KSI)
R-RATIO: .25
FREQUENCY: 200 CPH
CYCLES TO FAILURE: 1228 CYCLES
K(MAX) 296 CYCLES PRIOR TO FAILURE: 36.96 MPA SQRT(M) (33.64 KSI SQRT(IN))

CRACK LENGTH MM IN		CYCLES	DELTA (A)/DELTA (N) MM/CYCLE IN/CYCLE	DELTA (STRESS INTENSITY) MPA SQRT(M) KSI SQRT(IN)
5.80	.221	1	.5070E-03	.1999E-04
6.33	.249	1429	.9080E-03	.2310E-04
7.03	.277	261	.7304E-03	.2079E-04
8.28	.326	4329	.8310E-03	.3275E-04
9.20	.362	9439	.1003E-02	.3950E-04
10.19	.401	6428	.1609E-02	.6330E-04
11.39	.448	7165	.2579E-02	.1019E-03
12.39	.488	7994	.2430E-02	.9567E-04
13.12	.517	7894	.2800E-02	.1102E-03
13.72	.540	8069	.3075E-02	.1526E-03
14.63	.576	8303	.3394E-02	.1336E-03
15.60	.614	8590	.5949E-02	.2342E-03
16.03	.663	8796	.4331E-02	.1706E-03
17.76	.699	9012	.7524E-02	.2962E-03
18.76	.738	9144	.8935E-02	.3518E-03
19.77	.778	9257	.9744E-02	.3036E-03
21.46	.845	9431	.9907E-02	.3901E-03
23.25	.916	9612	.1630E-01	.6440E-03
24.76	.975	9794	.1743E-01	.6061E-03
26.14	1.029	9783	.1935E-01	.7617E-03
27.88	1.298	9873	.2368E-01	.9321E-03
29.46	1.160	9940		

TABLE D1-19

SPECIMEN NUMBER: 63-678
ALLOY TYPE: 2124-T861
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINT: STIFFENED
ENVIRONMENT: ARGON
TEST TEMPERATURE: 304.3 K
SPECIMEN THICKNESS: 1.65 MM (0.065 IN)
MAXIMUM STRESS: 198.7 MPA (28.8 KSI)
R-RATIO: .25
FREQUENCY: 200 CPH
CYCLES TO FAILURE: 1245 CYCLES
K(MAX) 60 CYCLES PRIOR TO FAILURE: 37.79 MPA SQRT(M) (34.19 KSI SQRT(IN))

CRACK LENGTH MM IN		CYCLES	DELTA (A)/DELTA (N) MM/CYCLE IN/CYCLE	DELTA (STRESS INTENSITY) MPA SQRT(M) KSI SQRT(IN)
3.69	.145	1	.2035E-02	.7093E-04
4.21	.166	262	.3395E-02	.1337E-03
4.73	.186	415	.4132E-02	.1627E-03
5.31	.209	557	.4814E-02	.1895E-03
5.82	.229	662	.4474E-02	.1761E-03
6.50	.256	815	.9419E-02	.3700E-03
7.10	.283	887	.7562E-02	.2977E-03
7.68	.302	951	.9458E-02	.3724E-03
8.40	.331	1029	.1246E-01	.4905E-03
9.12	.359	1087	.1047E-01	.7271E-03
9.73	.383	1123	.2430E-01	.9600E-03
10.71	.422	1160	.2906E-01	.1144E-02
11.44	.450	1185		

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TABLE D1-20

SPECIMEN NUMBER: 63-216
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: STIFF
ENVIRONMENT: ARGON
TEST TEMPERATURE: 303.2 K
SPECIMEN THICKNESS: 1.64 MM (0.0645 IN)
MAXIMUM STRESS: 75.2 MPa (10.9 KSI)
R-RATIO: 0
FREQUENCY: 200 CYCLES
CYCLES TO FAILURE: 26973
K(MAX) 161 CYCLES PRIOR TO FAILURE 61.41 MPa SQRT(M) (55.89 KSI SQRT(IN))

CRACK LENGTH MM	IN	CYCLES	DELTA(A)/DELTA(B) MM/CYCLE	IN/CYCLE	DELTA(Stress Intensity) MPa SQRT(IN)	RSI SQRT(IN)
9.36	.368					
10.01	.394	26975	.2453E-04	.9657E-06	6.57	5.98
10.64	.419	44139	.3700E-04	.1457E-05	6.79	6.17
11.14	.438	62317	.2717E-04	.1070E-05	6.97	6.34
12.17	.479	88130	.4015E-04	.1581E-05	7.21	6.57
13.02	.512	105654	.4819E-04	.1897E-05	7.51	6.83
13.69	.539	117799	.5542E-04	.2192E-05	7.73	7.04
14.30	.563	128796	.5595E-04	.2187E-05	7.92	7.21
15.05	.592	141679	.5796E-04	.2202E-05	8.11	7.38
15.58	.614	148974	.7347E-04	.2892E-05	8.29	7.55
16.29	.642	158243	.7673E-04	.3021E-05	8.47	7.70
16.99	.669	166883	.8099E-04	.3189E-05	8.66	7.88
17.55	.691	172439	.1008E-03	.3969E-05	8.82	8.03
18.18	.716	178021	.9573E-04	.3768E-05	8.98	8.17
18.76	.739	185730	.8594E-04	.3384E-05	9.14	8.31
19.68	.775	192693	.1317E-03	.5185E-05	9.33	8.49
21.12	.832	208692	.1206E-03	.4746E-05	9.62	8.76
22.61	.890	212847	.1827E-03	.7192E-05	9.98	9.18
23.87	.940	218495	.2224E-03	.8755E-05	10.31	9.38
25.81	1.016	225380	.2811E-03	.1107E-04	10.68	9.72
26.82	1.056	229029	.2788E-03	.1098E-04	11.01	10.02
28.49	1.122	233385	.3822E-03	.1595E-04	11.31	10.30
29.78	1.172	236595	.4023E-03	.1583E-04	11.64	10.59
31.25	1.230	239475	.5111E-03	.2012E-04	11.94	10.87
32.90	1.295	242432	.5592E-03	.2232E-04	12.28	11.17
34.26	1.349	244279	.7330E-03	.2886E-04	12.62	11.46
35.83	1.410	246455	.7214E-03	.2840E-04	12.91	11.75
37.24	1.466	248666	.6405E-03	.2521E-04	13.22	12.03
38.49	1.515	250038	.9099E-03	.3582E-04	13.50	12.28
40.01	1.575	251750	.8894E-03	.3502E-04	13.79	12.55
41.32	1.627	252897	.1143E-02	.4499E-04	14.08	12.81
42.99	1.692	254312	.1174E-02	.4622E-04	14.39	13.09
44.24	1.742	255308	.1256E-02	.4945E-04	14.69	13.37
45.52	1.792	256232	.1392E-02	.5482E-04	14.95	13.61
46.76	1.841	257142	.1357E-02	.5341E-04	15.21	13.84
48.29	1.897	258061	.1566E-02	.6166E-04	15.49	14.10
49.60	1.953	258999	.1501E-02	.5911E-04	15.79	14.37
50.95	2.006	259740	.1815E-02	.7146E-04	16.07	14.63
52.10	2.051	260260	.2215E-02	.8721E-04	16.34	14.87
53.44	2.104	260896	.2103E-02	.8278E-04	16.60	15.11
54.69	2.153	261494	.2096E-02	.8253E-04	16.87	15.36
55.92	2.201	261968	.2583E-02	.1017E-03	17.14	15.60
57.47	2.263	262643	.2307E-02	.9081E-04	17.44	15.87
58.85	2.317	263183	.2540E-02	.1000E-03	17.76	16.16
60.25	2.372	263884	.2809E-02	.1105E-03	18.06	16.44
61.51	2.421	264086	.3110E-02	.1228E-03	18.36	16.71
62.43	2.458	264328	.3810E-02	.1500E-03	18.60	16.93
63.84	2.513	264688	.3998E-02	.1574E-03	18.86	17.17
65.23	2.568	265016	.4162E-02	.1638E-03	19.19	17.46
67.19	2.645	265415	.4899E-02	.1929E-03	19.58	17.82
68.71	2.705	265773	.4300E-02	.1693E-03	19.99	18.19
70.46	2.774	266142	.4694E-02	.1848E-03	20.38	18.55
72.08	2.838	266453	.5219E-02	.2055E-03	20.80	18.93
73.78	2.905	266808	.4787E-02	.1885E-03	21.21	19.31
75.19	2.968	267037	.6134E-02	.2415E-03	21.61	19.67
77.60	3.055	267239	.1193E-01	.4696E-03	22.11	20.12
			.5169E-02	.2035E-03	22.92	20.86

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41.15	3.195	267927	.0467E-02	.3333E-03	24.04	21.80
45.34	3.360	268422	.1012E-01	.3982E-03	25.03	22.78
87.63	3.450	268648	.1129E-01	.4444E-03	25.72	23.41
89.66	3.530	268826	.1192E-01	.4694E-03	26.56	24.17
92.58	3.645	269873	.1531E-01	.6827E-03	27.70	25.21
96.01	3.780	269297	.1972E-01	.7764E-03	28.97	26.37
99.19	3.905	269458	.1490E-01	.5864E-03	30.14	27.43
101.60	4.000	269620				

TABLE D1-21

SPECIMEN NUMBER:
ALLOY TYPE:
SPECTIMEN ORIENTATION:
CONSTRAINT:
ENVIRONMENT:
TEST TEMPERATURE:
SPECIMEN THICKNESS:
MAXIMUM STRESS:
R-RATIO:
FREQUENCY:
CYCLES TO FAILURE:

63-1113
2024-T861
LONGITUDINAL
STIFFENED
ARGON
302.6 K
1.64 MM (.065 IN)
118.7 MPA (17.2 KSI)
50
230 CPM
41758 CYCLES

CRACK LENGTH MM IN	MM IN	CYCLES	DELTA (A)/DELTA (N) MM/CYCLE IN/CYCLE	DEI MPA	STRESS INTENSITY (N) KSI	INTENSITY SORT (IN)
7.32	.288	1				
7.92	.312	4309	.1397E-03	.5581E-05	8.37	
8.47	.334	8685	.1277E-03	.5028E-05	8.66	
8.91	.351	11760	.1401E-03	.5515E-05	9.02	
9.77	.384	16044	.1986E-03	.7820E-05	10.19	
11.30	.405	17845	.2955E-03	.1163E-04	10.56	
11.13	.438	19938	.3968E-03	.1562E-04	10.92	
11.76	.463	21415	.4248E-03	.1672E-04	11.29	
12.45	.490	22731	.5422E-03	.2135E-04	11.62	
13.52	.532	24429	.6152E-03	.2422E-04	12.04	
14.51	.571	25916	.6670E-03	.2626E-04	12.52	
15.43	.608	26933	.9118E-03	.3591E-04	12.95	
16.20	.638	27600	.1018E-02	.4007E-04	13.32	
16.95	.667	28331	.1157E-02	.4555E-04	13.64	
17.77	.700	29152	.1005E-02	.3959E-04	13.97	
18.38	.724	29595	.1362E-02	.5361E-04	14.27	
19.15	.754	30171	.1341E-02	.5278E-04	14.55	
20.44	.805	31063	.1444E-02	.5684E-04	14.96	
21.86	.861	31874	.1752E-02	.6899E-04	15.48	
23.55	.927	32771	.1887E-02	.7430E-04	16.08	
25.27	.995	33435	.2592E-02	.1020E-03	16.71	
26.62	1.048	33995	.2399E-02	.9446E-04	17.26	
28.13	1.107	34438	.3417E-02	.1345E-03	17.77	
29.24	1.151	34730	.3813E-02	.1503E-03	18.23	
30.78	1.212	35046	.4199E-02	.1653E-03	18.69	
31.96	1.258	35390	.4035E-02	.1588E-03	19.15	
33.37	1.314	35725	.4197E-02	.1652E-03	19.59	
34.85	1.372	35961	.6264E-02	.2466E-03	20.07	
36.06	1.451	36253	.8889E-02	.2712E-03	20.65	
38.36	1.510	36492	.6270E-02	.2469E-03	21.23	
40.29	1.586	36717	.8583E-02	.3174E-03	21.80	
41.51	1.634	36856	.8780E-02	.3457E-03	22.31	
43.57	1.716	37053	.1048E-01	.4127E-03	22.85	
44.84	1.765	37139	.1491E-01	.5871E-03	23.39	
46.96	1.849	37316	.1193E-01	.4645E-03	23.95	
48.49	1.909	37388	.2125E-01	.8368E-03	24.54	
51.14	2.013	37475	.3044E-01	.1198E-02	25.23	
52.13	2.052	37497	.4509E-01	.1775E-02	25.83	
58.01	2.284	37561	.8902E-01	.3505E-02	26.99	
60.60	2.362	37578	.1313E+00	.5247E-02	28.33	

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TABLE D1-22

SPECIMEN NUMBER: 63-2110
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINTS: STIFFENED
ENVIRONMENT: AIRCRAFT
TEST TEMPERATURE: 384.3 K
SPECIMEN THICKNESS: 1.63 MM (1/16 IN)
MAXIMUM STRESS: 223.5 MPA (32.3 KSI)
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 1655 CYCLES
K(MAX) 15 CYCLES PRIOR TO FAILURE: 67.00 MPA SQR(T(M)) (61.70 KSI SQR(T(IN))

CRACK LENGTH		CYCLES	DELTA(A)/DELTA(N)		DELTA(Stress Intensity)	
MM	IN		MM/CYCLE	IN/CYCLE	MPA SQR(T(M))	KSI SQR(T(IN))
5.29	.208	1	.9038E-03	.3558E-04	14.95	13.60
5.89	.232	660	.1429E-02	.5628E-04	15.80	14.38
6.59	.259	1154	.2230E-02	.8804E-04	16.90	15.38
7.68	.302	1639	.2836E-02	.1117E-03	18.12	16.49
8.72	.343	2008	.4017E-02	.1581E-03	19.17	17.45
9.61	.378	2229	.4399E-02	.1732E-03	19.98	18.18
10.27	.404	2380	.4703E-02	.1852E-03	20.59	18.73
10.82	.426	2498	.5337E-02	.2101E-03	21.09	19.19
11.30	.445	2587	.6469E-02	.2547E-03	21.68	19.73
12.06	.475	2704	.6368E-02	.2496E-03	22.40	20.39
12.87	.507	2831	.9407E-02	.3704E-03	22.99	20.93
13.37	.527	2885	.9306E-02	.3664E-03	23.46	21.35
13.91	.546	2943	.1150E-01	.4526E-03	24.88	21.92
14.81	.583	3021	.1044E-01	.4110E-03	24.84	22.61
15.71	.618	3107	.9954E-02	.3919E-03	25.52	23.22
16.45	.647	3181	.1420E-01	.5590E-03	26.10	23.75
17.16	.675	3231	.1420E-01	.5592E-03	26.86	24.26
17.85	.703	3283	.1968E-01	.7750E-03	27.21	24.76
18.56	.731	3316	.1720E-01	.6770E-03	28.14	25.61
20.28	.798	3416	.1945E-01	.7658E-03	29.33	26.69
21.76	.857	3492	.3172E-01	.1249E-02	30.40	27.67
23.25	.915	3539	.2847E-01	.1121E-02	31.51	28.67
24.90	.980	3597	.4883E-01	.1922E-02	32.57	29.64
26.32	1.036	3626	.9017E-01	.3580E-02	33.47	30.46
27.58	1.086	3648				

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TABLE D1-23

SPECIMEN NUMBER:
ALLOY TYPE:
SPECIMEN ORIENTATION:
CRACK LENGTH:
TEST TEMPERATURE:
SPECIMEN THICKNESS:
MAXIMUM STRESS:
R-RATIO:
CYCLES TO FAILURE:

93-877
2024-T861
100% R
1.63 MM (0.064 IN)
76.0 MPA (11.0 KSI)
288 MPa
106498 CYCLES

CRACK LENGTH MM	IN	CYCLES	DELTA (A)/DELTA (H) MM/CYCLE	IN/CYCLE	DELTA STRESS INTENSITY MPA SQRT (H)	KSI SQRT (IN)
10.94	.431					
11.52	.453	14683	.3944E-04	.1553E-05	7.01	6.38
12.08	.475	34348	.2056E-04	.1124E-05	7.19	6.54
12.67	.499	45334	.5406E-04	.2128E-05	7.37	6.71
13.37	.526	99961	.4750E-04	.1873E-05	7.56	6.88
13.84	.545	66823	.6922E-04	.2725E-05	7.73	7.04
14.39	.566	73741	.7839E-04	.3086E-05	7.88	7.17
15.20	.598	83765	.7938E-04	.3125E-05	8.07	7.34
16.13	.635	95188	.6388E-04	.3303E-05	8.31	7.56
16.78	.661	101851	.9624E-04	.3749E-05	8.52	7.76
17.42	.686	109692	.8163E-04	.3214E-05	8.70	7.91
18.02	.709	112881	.1888E-03	.7488E-05	8.86	8.06
18.67	.735	117414	.1434E-03	.5647E-05	9.02	8.21
19.43	.765	121672	.1774E-03	.6990E-05	9.28	8.37
20.76	.817	128645	.1907E-03	.7588E-05	9.45	8.68
22.29	.878	134585	.2587E-03	.1019E-04	9.60	8.92
23.46	.924	138887	.3325E-03	.1309E-04	10.12	9.21
25.03	.986	141978	.4051E-03	.1595E-04	10.44	9.58
26.72	1.052	149569	.4697E-03	.1849E-04	10.81	9.84
27.85	1.096	147869	.4909E-03	.1933E-04	11.13	10.12
29.97	1.180	150573	.7829E-03	.3082E-04	11.48	10.45
31.45	1.238	152335	.8433E-03	.3320E-04	11.87	10.88
33.00	1.299	154159	.8495E-03	.3344E-04	12.19	11.10
34.57	1.361	155499	.1100E-02	.4467E-04	12.52	11.48
36.02	1.411	156401	.1586E-02	.6246E-04	12.84	11.68
37.41	1.473	157449	.1327E-02	.5224E-04	13.13	11.95
39.01	1.536	158489	.1543E-02	.6073E-04	13.44	12.23
40.71	1.601	159405	.1857E-02	.7312E-04	13.78	12.54
42.38	1.668	160118	.2335E-02	.9194E-04	14.13	12.86
44.28	1.743	160962	.2251E-02	.8863E-04	14.49	13.19
45.82	1.804	161623	.2327E-02	.9160E-04	14.84	13.51
47.30	1.862	162061	.3392E-02	.1336E-03	15.15	13.79
49.74	1.958	162624	.4327E-02	.1703E-03	15.56	14.16
51.22	2.017	163083	.3917E-02	.1542E-03	15.96	14.53
52.61	2.071	163254	.5525E-02	.2175E-03	16.26	14.88
54.17	2.133	163654	.3902E-02	.1536E-03	16.57	15.08
55.43	2.182	164039	.3256E-02	.1282E-03	16.87	15.35
56.81	2.237	164213	.7963E-02	.3139E-03	17.15	15.61
58.20	2.291	164522	.4440E-02	.1764E-03	17.45	15.88
60.02	2.363	164847	.5627E-02	.2215E-03	17.88	16.19
61.81	2.434	165068	.8097E-02	.3188E-03	18.19	16.56
63.21	2.488	165174	.1316E-01	.5179E-03	18.55	16.88
64.75	2.549	165396	.6962E-02	.2741E-03	18.88	17.18
66.12	2.603	165519	.1113E-01	.4382E-03	19.21	17.48
67.46	2.656	165654	.9887E-02	.3893E-03	19.53	17.77
69.16	2.723	165776	.1392E-01	.5482E-03	19.88	18.09
70.48	2.775	165874	.1348E-01	.5386E-03	20.25	18.42

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TABLE D1-24

SPECIMEN NUMBER: 63-471
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINT: STIFFENED
ENVIRONMENT: ARCON
TEST TEMPERATURE: 303.1 K
SPECIMEN THICKNESS: 1.68 MM (0.066 IN)
MAXIMUM STRESS: 119.6 MPA (17.2 KSI)
R-RATIO: 0.5
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 22889
K(MAX) 116 CYCLES PRIOR TO FAILURE: 42.75 MPA SQR(T(M)) (34.91 KSI SQR(T(IN)))

CPACK LENGTH MM IN		CYCLES	DELTA(A)/DELTA(N) MM/CYCLE IN/CYCLE	DELTA(Stress Intensity) MPa SQR(T(M)) KSI SQR(T(IN))
7.90	.311	1	.1916E-03 .7543E-05	9.09 8.82
9.05	.354	5967	.2423E-03 .9539E-05	10.25 9.33
9.90	.390	9484	.3989E-03 .1571E-04	10.72 9.76
10.80	.425	11738	.6780E-03 .2638E-04	11.43 10.40
12.67	.499	14530	.8314E-03 .3273E-04	12.13 11.04
13.73	.540	15034	.9849E-03 .3877E-04	12.60 11.46
14.68	.578	16775	.1426E-02 .5615E-04	12.93 11.77
15.23	.600	17157	.1725E-02 .6790E-04	13.25 12.06
16.13	.635	17682	.9566E-03 .3767E-04	13.54 12.32
16.55	.652	18120	.2203E-02 .8990E-04	13.81 12.57
17.43	.686	18506	.1027E-02 .7192E-04	14.15 12.88
18.18	.716	18912	.2273E-02 .8949E-04	14.45 13.15
18.89	.744	19226	.2671E-02 .1052E-03	14.89 13.55
20.42	.804	19797	.2948E-02 .1161E-03	15.54 14.14
22.22	.875	20410	.3167E-02 .1247E-03	16.13 14.68
23.51	.926	20817	.3298E-02 .1298E-03	16.65 15.19
25.04	.986	21281	.5476E-02 .2156E-03	17.21 15.66
26.62	1.048	21978	.6886E-02 .2711E-03	17.77 16.17
28.17	1.109	21795	.8354E-02 .3298E-03	18.27 16.82
29.49	1.161	21952	.6648E-02 .2617E-03	18.78 17.89
31.13	1.225	22199	.9164E-02 .3608E-03	19.41 17.66
33.21	1.307	22426	.1640E-01 .6456E-03	20.28 18.38
35.82	1.410	22585	.2119E-01 .8341E-03	21.88 19.11
38.08	1.499	22692		

TABLE D1-25

SPECIMEN NUMBER: 63-3111
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINT: STIFFENED
ENVIRONMENT: ARCON
TEST TEMPERATURE: 304.1 K
SPECIMEN THICKNESS: 1.63 MM (0.064 IN)
MAXIMUM STRESS: 198.6 MPA (28.8 KSI)
R-RATIO: 0.5
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 1892
K(MAX) 11 CYCLES PRIOR TO FAILURE: 45.86 MPA SQR(T(M)) (41.73 KSI SQR(T(IN)))

CPACK LENGTH MM IN		CYCLES	DELTA(A)/DELTA(N) MM/CYCLE IN/CYCLE	DELTA(Stress Intensity) MPa SQR(T(M)) KSI SQR(T(IN))
5.29	.208	1	.1453E-02 .5722E-04	13.35 12.15
6.21	.44	631	.2529E-02 .9958E-04	14.37 13.88
7.11	.280	988	.4384E-02 .1726E-03	15.16 13.88
7.73	.303	1123	.5254E-02 .2068E-03	15.83 14.41
8.43	.332	1262	.4283E-02 .1686E-03	16.61 15.11
9.31	.366	1466	.6016E-02 .2369E-03	17.34 15.78
10.02	.394	1584	.1084E-01 .4266E-03	18.18 16.47
11.11	.434	1676	.1287E-01 .5865E-03	19.07 17.35
12.30	.484	1776	.1773E-01 .6982E-03	19.99 18.19
13.27	.523	1831	.5246E-01 .2066E-02	20.96 19.07
14.80	.583	1868	.9144E-01 .3606E-02	22.24 20.24
16.72	.658	1881		

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TABLE D1-26

SPECIMEN NUMBER: 2024-T861
ALLOY TYPE: 2024-T861
ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
TEST METHOD: ASTM E399
SPECIMEN THICKNESS: 3.18 mm
MAXIMUM STRESS: 75.2 MPa (10.9 KSI)
R-RATIO: 0.1
CYCLES TO FAILURE: 89365
K(MAX): 125 CYCLES PRIOR TO FAILURE
40.57 MPa (5.90 KSI) 14.92 KSI (SORTIN)

CRACK LENGTH mm	IN	CYCLES	DELTA(IAS)/CYCLE mm/cycle	DELTA(AS)/CYCLE IN/cycle	DELTA(AS) STRESS MPa SORTIN	INTENSITY KSI SORTIN
6.99	.275	17144	.716E-04	.2742E-04	11.75	10.06
7.21	.283	17211	.7711E-04	.3635E-04	11.76	10.70
7.43	.292	17291	.1234E-03	.4425E-04	12.27	11.12
7.65	.301	17345	.1146E-03	.4517E-04	12.66	11.61
7.87	.310	17409	.1467E-03	.5774E-04	13.37	11.70
8.09	.319	17463	.1341E-03	.7249E-04	13.52	12.30
8.31	.328	17517	.1717E-03	.6754E-04	13.94	12.49
8.53	.337	17571	.2304E-03	.9154E-04	14.33	11.24
8.75	.346	17625	.2471E-03	.9473E-04	14.70	11.37
8.97	.355	17679	.2411E-03	.1107E-04	15.07	11.72
9.19	.364	17733	.2647E-03	.1144E-04	15.45	14.16
9.41	.373	17787	.3345E-03	.1317E-04	15.75	14.34
9.63	.382	17841	.2226E-03	.1152E-04	16.07	14.59
9.85	.391	17895	.5322E-03	.2231E-04	16.32	14.86
10.07	.400	17949	.4442E-03	.1733E-04	16.61	15.12
10.29	.409	18003	.6666E-03	.2257E-04	16.90	15.38
10.51	.418	18057	.4747E-03	.1859E-04	17.23	15.68
10.73	.427	18111	.6713E-03	.2249E-04	17.49	16.11
10.95	.436	18165	.7334E-03	.2884E-04	18.17	16.45
11.17	.445	18219	.7350E-03	.3137E-04	18.75	17.17
11.39	.454	18273	.9763E-03	.3144E-04	19.49	17.73
11.61	.463	18327	.1206E-02	.4745E-04	20.13	18.32
11.83	.472	18381	.1211E-02	.4764E-04	20.78	18.91
12.05	.481	18435	.1492E-02	.5876E-04	21.44	19.51
12.27	.490	18489	.1597E-02	.6286E-04	22.17	20.14
12.49	.499	18543	.1373E-02	.7793E-04	22.60	20.57
12.71	.508	18597	.1161E-02	.7322E-04	23.17	21.08
12.93	.517	18651	.2594E-02	.1002E-03	23.72	21.59
13.15	.526	18705	.2004E-02	.1025E-03	24.13	22.15
13.37	.535	18759	.2705E-02	.1065E-03	24.75	22.62
13.59	.544	18813	.2503E-02	.9854E-04	25.27	23.10
13.81	.553	18867	.3116E-02	.1294E-03	25.91	23.49
14.03	.562	18921	.1361E-02	.1402E-03	26.17	23.99
14.25	.571	18975	.1393E-02	.1544E-03	26.57	24.46
14.47	.580	19029	.4154E-02	.1836E-03	27.36	24.90
14.69	.589	19083	.4386E-02	.1727E-03	27.32	25.41
14.91	.598	19137	.4757E-02	.1873E-03	28.57	25.96
15.13	.607	19191	.5212E-02	.2052E-03	28.11	26.49
15.35	.616	19245	.5970E-02	.2351E-03	29.53	26.96
15.57	.625	19299	.5184E-02	.2042E-03	30.10	27.39
15.79	.634	19353	.7434E-02	.2927E-03	30.61	27.95
16.01	.643	19407	.7235E-02	.2865E-03	31.23	28.42
16.23	.652	19461	.7217E-02	.2841E-03	31.42	28.95
16.45	.661	19515	.7594E-02	.3011E-03	32.50	29.58
16.67	.670	19569	.1103E-01	.3944E-03	33.53	30.51
16.89	.679	19623	.1257E-01	.4949E-03	34.27	31.19
17.11	.688	19677	.1351E-01	.6135E-03	34.93	31.78
17.33	.697	19731	.1421E-01	.6382E-03	35.66	32.44
17.55	.706	19785	.1563E-01	.7727E-03	36.43	33.15
17.77	.715	19839	.2292E-01	.9023E-03	37.17	33.83
17.99	.724	19893	.2594E-01	.1021E-02	37.36	34.55

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TABLE D1-27

SPECIMEN NUMBERS
ALLOY TYPE
SPECIMEN ORIENTATION
CONSTRAINT
ENVIRONMENT
TEST TEMPERATURE
SPECIMEN THICKNESS
MAXIMUM STRESS
R-RATIO
FREQUENCY
CYCLES TO FAILURE
K(MAY) 102 CYCLES PRIOR TO FAILURE

U63-2L2
2024-T861
LONGITUDINAL
UNSTIFFENED
ARGON
332.0 K
1.65 MM (0.0650 IN)
118.6 MPA (17.2 KSI)
25
280 CPM
165% CYCLES
43.64 MPA SORT(M) (39.72 KSI SORT(M))

CRACK LENGTH MM	IN	CYCLES	DELTA (A)/DELTA (IN) MM/CYC	IN/CYC	DELTA (STRESS INTENSITY) MPA SORT(M)	KSI SORT(IN)
5.41	.213	1	.2105E-01	.8206E-05	15.02	13.67
5.49	.213	2333	.2962E-03	.1127E-04	15.76	14.34
6.54	.258	4573	.4653E-03	.1846E-04	16.48	15.10
7.06	.278	5675	.5037E-03	.1943E-04	17.27	15.72
7.67	.300	7276	.6494E-03	.2554E-04	18.11	16.48
8.54	.336	8336	.8543E-03	.3364E-04	18.94	17.24
9.73	.370	9293	.1095E-02	.4310E-04	19.78	18.00
10.14	.399	9987	.1222E-02	.4811E-04	20.53	18.68
10.79	.424	11594	.1134E-02	.4345E-04	21.21	19.30
11.53	.454	11144	.1655E-02	.6516E-04	21.93	19.96
12.42	.493	11715	.2134E-02	.8654E-04	22.74	20.69
13.33	.526	14123	.2141E-02	.8430E-04	23.48	21.37
14.08	.554	12603	.2631E-02	.1036E-03	24.23	22.05
15.04	.573	12847	.2743E-02	.1095E-03	24.97	22.72
15.85	.624	13135	.2630E-02	.1027E-03	25.62	23.32
16.63	.655	13433	.3640E-02	.1433E-03	26.28	23.91
17.47	.684	13670	.4349E-02	.1594E-03	27.02	24.59
18.53	.731	13931	.4141E-02	.1630E-03	27.77	25.27
19.42	.765	14166	.4674E-02	.1840E-03	28.73	26.15
21.00	.830	14533	.6336E-02	.2444E-03	29.44	27.24
22.70	.894	14753	.5933E-02	.2336E-03	31.14	28.34
24.43	.964	15359	.7813E-02	.3075E-03	32.38	29.47
26.27	1.034	15247	.9674E-02	.3423E-03	33.58	30.55
28.00	1.103	15484	.1137E-01	.4445E-03	34.55	31.44
29.29	1.143	15531	.1162E-01	.4574E-03	35.57	32.17
31.14	1.226	15754	.1303E-01	.5444E-03	36.60	33.31
32.77	1.275	15863	.1511E-01	.6342E-03	37.60	34.22
34.16	1.343	15465	.1674E-01	.6804E-03	38.62	35.14
35.54	1.401	14044	.1744E-01	.7023E-03	39.76	36.19
37.00	1.452	16174	.2441E-01	.9619E-03	40.94	37.29
38.47	1.514	14234				

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TABLE D1-28

SPECIMEN NUMBER:	U63-1L4
ALLOY TYPE:	2024-T861
SPECIMEN ORIENTATION:	LONGITUDINAL
CONSTRAINT:	UNSTIFFENED
ENVIRONMENT:	ARGON
TEST TEMPERATURE:	304.3 K
SPECIMEN THICKNESS:	1.65 MM (.0650 IN)
MAXIMUM STRESS:	217.6 MPA (31.6 KSI)
R-RATIO:	.05
FREQUENCY:	280 CPM
CYCLES TO FAILURE:	1178 CYCLES
K(MAX) 12 CYCLES PRIOR TO FAILURE:	57.18 MPA SQRT(M); 52.03 KSI SQRT(IN)

CRACK LENGTH		CYCLES	DELTA (AI)/DELTA (NI)		DELTA (STRESS INTENSITY)	
MM	IN		MM/CYCLE	IN/CYCLE	MPA SQRT(M)	KSI SQRT(IN)
4.12	.162	1	.3450E-02	.1358E-03	24.87	22.63
5.09	.200	240	.4674E-02	.1840E-03	27.62	24.59
5.77	.227	427	.8476E-02	.3337E-03	28.79	26.20
6.55	.258	519	.6798E-02	.2641E-03	30.86	28.08
7.60	.299	675	.9873E-02	.3887E-03	32.95	29.90
8.62	.335	768	.1042E-01	.4093E-03	34.77	31.64
9.41	.373	854	.1230E-01	.4842E-03	36.51	33.23
10.34	.407	930	.1989E-01	.7816E-03	38.26	34.82
11.32	.446	979	.2253E-01	.8871E-03	39.80	36.22
12.11	.477	1014	.3212E-01	.1265E-02	41.32	37.60
13.10	.516	1045	.3321E-01	.1307E-02	42.87	39.11
14.00	.551	1072	.4916E-01	.1935E-02	44.25	40.27
14.83	.584	1089	.5193E-01	.2044E-02	45.62	41.52
15.77	.621	1107	.4932E-01	.1942E-02	47.80	42.77
16.66	.656	1125	.5623E-01	.2214E-02	48.40	44.34
17.17	.696	1143	.1708E+00	.6725E-02	50.11	45.60
19.03	.749	1151	.1595E+00	.6260E-02	52.71	47.97
21.42	.843	1166				

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TABLE D1-29

SPECIMEN NUMBER: 442-472						
SPECTION ORIENTATION: 288 CYCLES						
SPECTION Y THICKNESS: 1.68 MM (0.066 IN)						
SPECTION Y THICKNESS: 74.5 MPA (10.8 KSI)						
MAXIMUM STRESS: 32.04 KSI (307.11 MPa)						
FREQUENCY: 288 CYCLES						
CYCLES TO FAILURE: 43367 CYCLES						
K(HAKI) 378 CYCLES PRIOR TO FAILURE: 35.20 MPA SQRT(IN) (32.04 KSI SQRT(IN))						
CRACK LENGTH IN	MM	CYCLES	DELTA (A)/DELTA (N) MM/CYCLE	IN/CYCLE	DELTA (STRESS INTENSITY) MPA SQRT(IN)	KSI SQRT(IN)
7.94	.313	1	.1916E-03	.7544E-05	11.40	10.45
8.76	.345	4276	.1971E-03	.7759E-05	12.00	10.92
9.47	.373	7859	.2326E-03	.9156E-05	12.43	11.31
10.89	.397	10513	.3309E-03	.1333E-04	12.86	11.71
10.85	.427	12764	.3227E-03	.1271E-04	13.33	12.13
11.61	.457	15137	.3693E-03	.1533E-04	13.77	12.53
12.32	.485	16941	.4454E-03	.1754E-04	14.25	12.97
13.29	.523	19128	.2050E-03	.1125E-04	14.68	13.36
13.86	.546	21123	.4779E-03	.1882E-04	15.07	13.72
14.73	.580	22946	.3466E-03	.1365E-04	15.52	14.12
15.53	.611	25258	.6279E-03	.2472E-04	15.92	14.48
16.26	.640	26417	.4961E-03	.1953E-04	16.31	14.84
17.06	.672	28035	.5992E-03	.2359E-04	16.85	15.33
18.45	.726	30343	.1004E-02	.3953E-04	17.44	15.87
19.49	.767	31379	.9745E-03	.3836E-04	18.14	16.51
21.42	.843	33360	.9797E-03	.3857E-04	18.90	17.20
22.82	.898	34795	.1552E-02	.6110E-04	19.53	17.77
24.22	.954	35696	.1560E-02	.6220E-04	20.19	18.38
25.88	1.019	36749	.2072E-02	.8159E-04	20.85	18.98
27.31	1.075	37436	.2011E-02	.7910E-04	21.44	19.51
28.66	1.128	38106	.2843E-02	.1119E-03	22.12	20.13
30.60	1.205	38789	.3038E-02	.1196E-03	22.88	20.82
32.38	1.275	39375	.2922E-02	.1150E-03	23.55	21.43
33.96	1.337	39917	.4151E-02	.1634E-03	24.21	22.04
35.69	1.405	40334	.5008E-02	.1972E-03	24.92	22.68
37.56	1.479	40706	.4871E-02	.1916E-03	25.54	23.24
38.83	1.529	40967	.5470E-02	.2153E-03	26.15	23.80
40.68	1.602	41336	.6406E-02	.2522E-03	26.79	24.38
42.12	1.658	41531	.6747E-02	.2656E-03	27.42	24.95
43.89	1.728	41793	.9277E-02	.3653E-03	28.08	25.56
45.63	1.793	41970	.1037E-01	.4084E-03	28.77	26.19
47.44	1.868	42154	.8821E-02	.3473E-03	29.40	26.76
48.75	1.919	42302	.1105E-01	.4352E-03	29.99	27.30
50.46	1.987	42457	.1258E-01	.4952E-03	30.62	27.86
51.89	2.043	42571	.1195E-01	.4703E-03	31.19	28.39
53.36	2.101	42694	.1588E-01	.6250E-03	31.80	28.94
54.92	2.162	42792	.1426E-01	.5616E-03	32.47	29.55
56.70	2.232	42917	.2071E-01	.8153E-03	33.14	30.16
58.19	2.291	42989				

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TABLE D1-30

SPECIMEN NUMBERS			TEST PARAMETERS			
SPECIMEN ORIENTATION			TEST TEMPERATURE			
CONTRAINTS			SPECIMEN THICKNESS			
TEST TEMPERATURE			MAXIMUM STRESS			
SPECIMEN THICKNESS			FREQUENCY			
MAXIMUM STRESS			CYCLES TO FAILURE			
FREQUENCY			K(MAX)			
CYCLES TO FAILURE			41.83 MPA SQRT(M)			
K(MAX)			37.34 KSI SQRT(IN)			
CRACK LENGTH			DELTA (A)/DELTA (I)			
IN			IN/CYCLE			
MM			DELTA (STRESS INTENSITY)			
MM			MPA SQRT(M)			
IN			KSI SQRT(IN)			
CYCLES						
7.49	.295	1	.7077E-04	.2706E-05	11.10	10.10
8.12	.320	8956	.1150E-03	.4529E-05	11.70	10.65
9.19	.362	10274	.1090E-03	.4136E-05	12.41	11.29
10.26	.404	20454	.2966E-03	.1168E-04	12.92	11.76
10.81	.426	30380	.1506E-03	.5930E-05	13.27	12.07
11.40	.449	34220	.2243E-03	.8032E-05	13.63	12.41
12.04	.474	37045	.3029E-03	.1192E-04	14.04	12.77
12.79	.503	39519	.2162E-03	.8511E-05	14.45	13.15
13.50	.531	42797	.3370E-03	.1327E-04	14.87	13.54
14.32	.564	45254	.3819E-03	.1502E-04	15.33	13.95
15.17	.597	47460	.4070E-03	.1606E-04	15.71	14.29
15.77	.621	48944	.4023E-03	.1099E-04	16.03	14.59
16.43	.647	50316	.5201E-03	.2079E-04	16.40	14.92
17.21	.677	51703	.5712E-03	.2249E-04	16.82	15.30
18.11	.713	53366	.7931E-03	.3122E-04	17.21	15.66
18.83	.741	54274	.8069E-03	.3175E-04	17.76	16.16
20.41	.804	56233	.1092E-02	.4380E-04	18.43	16.70
21.71	.855	57426	.1114E-02	.4385E-04	19.03	17.32
23.05	.907	58622	.1564E-02	.6156E-04	19.66	17.89
24.54	.966	59578	.1727E-02	.6001E-04	20.30	18.40
26.00	1.024	60422	.1880E-02	.7402E-04	20.92	19.04
27.44	1.080	61193	.2192E-02	.8629E-04	21.56	19.62
29.05	1.144	61923	.2777E-02	.1093E-03	22.10	20.19
30.43	1.198	62422	.3279E-02	.1291E-03	22.79	20.74
32.02	1.261	62905	.3688E-02	.1452E-03	23.43	21.32
33.63	1.324	63341	.4754E-02	.1872E-03	24.09	21.93
35.33	1.391	63699	.3759E-02	.1480E-03	24.71	22.49
36.74	1.447	64076	.6473E-02	.2540E-03	25.29	23.02
38.29	1.507	64314	.5743E-02	.2261E-03	25.90	23.57
39.86	1.568	64584	.6929E-02	.2720E-03	26.51	24.12
41.40	1.630	64810	.6814E-02	.2683E-03	27.07	24.64
42.74	1.683	65007	.7711E-02	.3036E-03	27.61	25.12
44.14	1.738	65188	.9757E-02	.3841E-03	28.11	25.58
45.34	1.785	65311	.8375E-02	.3297E-03	28.63	26.06
46.81	1.843	65486	.1171E-01	.4609E-03	29.10	26.56
48.15	1.896	65601	.9479E-02	.3732E-03	29.75	27.08
49.71	1.957	65765	.1253E-01	.4934E-03	30.30	27.50
50.95	2.006	65864	.1539E-01	.6050E-03	30.97	28.19
53.09	2.090	66003	.2163E-01	.8515E-03	31.64	28.83
54.49	2.145	66068	.2209E-01	.8699E-03	32.33	29.42
56.33	2.210	66191	.1909E-01	.7517E-03	32.94	29.97
57.47	2.263	66211	.2404E-01	.9779E-03	33.52	30.50
59.16	2.329	66279	.2434E-01	.9502E-03	34.14	31.07
60.50	2.382	66334	.3686E-01	.1451E-02	34.75	31.62
62.05	2.443	66376	.3446E-01	.1357E-02	35.36	32.10
63.36	2.494	66414	.4956E-01	.1951E-02	36.16	32.91
65.78	2.590	66463	.6779E-01	.2669E-02	37.01	33.60
67.21	2.646	66484	.4667E-01	.1837E-02	37.70	34.31
68.89	2.712	66520	.5884E-01	.2317E-02	38.28	34.84
69.77	2.747	66535	.5194E-01	.2045E-02	38.60	35.13
70.29	2.767	66545	.5512E-01	.2170E-02	38.85	35.35
70.84	2.789	66555				

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TABLE D1-31

SPECIMEN NUMBER: U63-673			2024-T861			
ALLOY TYPE: 2024-T861			TRANSVERSE			
SPECIMEN ORIENTATION: TRANSVERSE			UNSTIFFENED			
CONSTRAINT: NONE			302.6 K			
ENVIRONMENT: 302.6 K			1.68 MM (1.068 IN)			
TEST TEMPERATURE: 302.6 K			101.1 MPA (14.7 KSI)			
SPECIMEN THICKNESS: 1.68 MM			200 CPM			
MAXIMUM STRESS: 101.1 MPA			1222 CYCLES			
R-RATIO: 0			CYCLES TO FAILURE: 375			
FREQUENCY: 200 CPM			31.67 MPA SQR(T IN) (28.02 KSI SQR(T IN))			
CYCLES TO FAILURE: 375						
CRACK LENGTH MM IN		CYCLES	DELTA (A)/DELTA (IN) MM/CYCLE IN/CYCLE	DELTA (STRESS INTENSITY) MPA SQR(T IN) KSI SQR(T IN)		
5.29	.208	1	.3121E-03	.1229E-04	12.86	11.78
6.10	.240	2597	.4212E-03	.1698E-04	13.76	12.92
6.93	.273	4560	.7203E-03	.2836E-04	14.65	13.34
7.85	.309	5833	.8750E-03	.3449E-04	15.52	14.13
8.72	.343	6833	.1110E-02	.4370E-04	16.26	14.79
9.44	.372	7476	.1356E-02	.5338E-04	16.94	15.42
10.28	.405	8097	.1637E-02	.6447E-04	17.69	16.18
11.18	.440	8650	.1625E-02	.6398E-04	18.40	16.74
12.01	.473	9158	.2564E-02	.1009E-03	19.10	17.38
12.96	.510	9529	.2587E-02	.9870E-04	19.80	18.82
13.83	.544	9874	.2914E-02	.1147E-03	20.47	18.63
14.78	.582	10208	.3829E-02	.1507E-03	21.09	19.28
15.55	.612	10402	.4995E-02	.1809E-03	21.61	19.67
16.25	.640	10554	.4515E-02	.1777E-03	22.15	20.16
17.11	.674	10745	.7995E-02	.3148E-03	22.77	20.73
18.09	.712	10867	.6128E-02	.2413E-03	23.40	21.30
19.00	.748	11016	.8701E-02	.3426E-03	24.17	21.99
20.46	.806	11184	.8102E-02	.3198E-03	25.15	22.89
22.11	.878	11387	.1426E-01	.5613E-03	26.15	23.88
23.75	.935	11502	.1319E-01	.5193E-03	27.18	24.74
25.55	1.006	11639	.1920E-01	.7561E-03	28.12	25.59
26.97	1.062	11713	.1811E-01	.6351E-03	28.93	26.33
28.38	1.117	11800	.2755E-01	.1085E-02	29.71	27.04
29.73	1.170	11849				

TABLE D1-32

SPECIMEN NUMBER: U63-375			2024-T861			
ALLOY TYPE: 2024-T861			TRANSVERSE			
SPECIMEN ORIENTATION: TRANSVERSE			UNSTIFFENED			
CONSTRAINT: NONE			302.6 K			
ENVIRONMENT: 302.6 K			1.63 MM (1.068 IN)			
TEST TEMPERATURE: 302.6 K			198.7 MPA (28.6 KSI)			
SPECIMEN THICKNESS: 1.63 MM			728 CYCLES			
MAXIMUM STRESS: 198.7 MPA			CYCLES TO FAILURE: 2			
R-RATIO: 0			53.01 MPA SQR(T IN) (48.25 KSI SQR(T IN))			
FREQUENCY: 200 CPM						
CYCLES TO FAILURE: 2						
CRACK LENGTH MM IN		CYCLES	DELTA (A)/DELTA (IN) MM/CYCLE IN/CYCLE	DELTA (STRESS INTENSITY) MPA SQR(T IN) KSI SQR(T IN)		
4.83	.190	1	.4744E-02	.1868E-03	24.47	22.27
5.86	.231	220	.5470E-02	.2194E-03	26.54	24.16
6.70	.264	373	.1088E-01	.4283E-03	28.18	25.64
7.45	.293	442	.1356E-01	.5348E-03	29.58	26.91
8.13	.320	492	.1496E-01	.5890E-03	31.28	28.46
9.28	.365	569	.4638E-01	.1826E-02	33.47	30.46
10.63	.418	598	.2228E-01	.8771E-03	35.66	32.45
11.94	.470	657	.4544E-01	.1789E-02	37.51	34.13
12.99	.511	680	.1110E+00	.4369E-02	39.37	35.83
14.43	.568	693	.1092E+00	.4380E-02	41.19	37.49
15.52	.611	703	.2650E+00	.1043E-01	43.58	39.66
17.91	.705	712	.6924E+00	.2726E-01	47.82	43.52
22.06	.869	718				

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TABLE D1-33

SPECIMEN NUMBER: U63-2L12
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
ENVIRONMENT: NET AIR
TEST TEMPERATURE: 300.9 K
SPECIMEN THICKNESS: 1.61 MM (.6339 IN)
MAXIMUM STRESS: 75.2 MPA (10.9 KSI)
R-RATIO: .05
FREQUENCY: 280 CPN
CYCLES TO FAILURE: 46457 CYCLES
K(MAX): 1 CYCLES PRIOR TO FAILURE: 52.60 MPA SQRT(IN) 47.94 KSI SQRT(IN)

CRACK LENGTH MM	IN	CYCLES	DELTA (A1)/DELTA (A2) MM/CYCLE	IN/CYCLE	DELTA (STRESS INTENSITY) MPA SQRT(IN)	KSI SQRT(IN)
7.65	.278	1	.2331E-03	.7997E-05	10.88	9.90
7.64	.278	3102	.2348E-03	.9402E-05	11.36	10.34
8.27	.299	5979	.2409E-03	.9485E-05	11.84	10.78
9.05	.316	8431	.2638E-03	.1039E-04	12.31	11.20
9.76	.344	11493	.2916E-03	.1148E-04	12.81	11.65
10.59	.377	14354	.3136E-03	.1235E-04	13.26	12.07
11.20	.401	16312	.3331E-03	.1430E-04	13.67	12.44
11.94	.429	18349	.3594E-03	.1415E-04	14.10	12.83
12.67	.459	21355	.4544E-03	.1791E-04	14.52	13.22
13.40	.488	24969	.4528E-03	.1783E-04	14.92	13.58
14.18	.514	28474	.4397E-03	.2125E-04	15.35	13.97
14.98	.540	32137	.5565E-03	.2191E-04	15.76	14.34
15.60	.564	36262	.6011E-03	.2364E-04	16.15	14.70
16.47	.594	37703	.7248E-03	.2454E-04	16.60	15.11
17.36	.624	38913	.7278E-03	.2865E-04	16.99	15.47
18.45	.671	39677	.8453E-03	.3330E-04	17.39	15.82
19.96	.746	39949	.9211E-03	.3626E-04	17.94	16.32
21.45	.802	33647	.1095E-02	.4339E-04	18.57	16.90
23.04	.867	34844	.1125E-02	.4424E-04	19.19	17.46
24.72	.907	35921	.1224E-02	.4417E-04	19.79	18.11
26.41	.961	35874	.1434E-02	.5661E-04	20.37	18.54
27.13	.974	37543	.1845E-02	.7427E-04	20.96	19.18
28.56	1.125	34333	.1987E-02	.7825E-04	21.57	19.63
29.74	1.171	34916	.2045E-02	.8052E-04	22.14	20.15
31.47	1.173	37434	.2203E-02	.8674E-04	22.64	20.60
32.22	1.164	39951	.2725E-02	.1.273E-03	23.15	21.07
33.64	1.174	40471	.2682E-02	.1056E-03	23.69	21.56
34.88	1.173	40942	.3153E-02	.1203E-03	24.84	22.61
36.71	1.146	41533	.3424E-02	.1192E-03	25.53	23.23
38.37	1.192	42034	.3873E-02	.1525E-03	26.14	23.79
39.87	1.167	42342	.4171E-02	.1622E-03	26.71	24.31
41.23	1.192	42739	.4661E-02	.1837E-03	27.33	24.87
42.95	1.161	43116	.4053E-02	.1952E-03	27.97	25.46
44.51	1.172	43421	.5061E-02	.2229E-03	28.54	25.97
46.83	1.144	43694	.4644E-02	.2222E-03	29.02	26.41
48.54	1.144	43852	.5513E-02	.2167E-03	29.51	26.85
49.32	1.171	44074	.9792E-02	.2243E-03	30.07	27.37
50.79	1.160	46359	.7198E-02	.2834E-03	30.69	27.91
51.29	1.173	46574	.1.155E-01	.4154E-03	31.65	28.81
F	54.11	46883	.8255E-02	.3257E-03	32.64	29.70
F	54.26	45743	.7822E-02	.3602E-03	33.61	

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F	10.31	2.335	45443	.1116E-01	.4003E-03	14.67	31.55
F	11.34	2.415	45643	.1143E-01	.4500E-03	15.35	32.17
F	12.44	2.462	45743	.1190E-01	.7500E-03	16.00	32.76
F	14.39	2.535	45843	.1197E-01	.5501E-03	16.72	33.42
F	15.79	2.592	45943	.1524E-01	.6000E-03	17.37	34.11
F	17.31	2.650	46243	.2544E-01	.1000E-02	18.29	34.85
F	19.85	2.753	46143	.3556E-01	.1400E-02	19.29	35.76
F	21.61	2.823	46233	.2246E-01	.9300E-03	19.96	36.39
F	23.77	2.865	46283	.2794E-01	.1100E-02	20.59	36.94
F	24.17	2.922	46333	.4314E-01	.1700E-02	21.47	37.74
F	26.33	3.005	46343	.1164E+00	.4600E-02	22.76	38.31
F	29.25	3.120	46403	.1219E+00	.4800E-02	24.34	41.35
F	32.71	3.242	46433	.1770E+00	.7000E-02	25.67	41.56
F	34.67	3.313	46443	.3816E+00	.1500E-01	26.73	42.52
F	34.94	3.385	46444	.5197E+00	.2124E-01	27.93	43.62
F	38.14	3.472	46452	.5719E+00	.2250E-01	29.31	44.97
F	38.42	3.580	46454				

TABLE D1-34

SPECIMEN NUMBER: U63-3L1
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
ENVIRONMENT: NET AIR
TEST TEMPERATURE: 303.9 K
SPECIMEN THICKNESS: 1.63 MM (.0640 IN)
MAXIMUM STRESS: 118.6 MPA (17.2 KSI)
R-RATIO: .05
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 7313 CYCLES
K(MAX) 1 CYCLES PRIOR TO FAILURE: 57.01 MPA SQRT(IN) (51.88 KSI SQRT(IN))

CRACK LENGTH		CYCLES	DELTA(KA)/DELTA(N)		DELTA(STRESS INTENSITY)	
MM	IN		MM/CYCLE	IN/CYCLE	MPA SQRT(IN)	KSI SQRT(IN)
8.02	.316	1	.6407E-03	.2523E-04	18.50	16.84
9.09	.358	1663	.1190E-02	.4687E-04	19.52	17.77
9.44	.371	2378	.1621E-02	.6383E-04	20.25	18.43
10.52	.414	2736	.2083E-02	.8201E-04	20.91	19.03
11.28	.444	3103	.1612E-02	.6346E-04	21.55	19.61
11.85	.466	3453	.2536E-02	.9984E-04	22.19	20.20
12.65	.498	3771	.2740E-02	.1082E-03	22.88	20.82
13.76	.526	4327	.2787E-02	.1097E-03	23.61	21.48
14.32	.563	4366	.3361E-02	.1563E-03	24.46	22.26
15.75	.624	4633	.2994E-02	.1163E-03	25.28	23.01
16.27	.640	4940	.5096E-02	.2002E-03	26.19	23.74
17.35	.683	5153	.4447E-02	.1751E-03	26.98	24.55
18.52	.729	5416	.5547E-02	.2144E-03	27.80	25.30
19.44	.767	5533	.5571E-02	.2193E-03	28.52	25.95
20.42	.804	5754	.6491E-02	.2554E-03	29.38	26.74
21.81	.859	5972	.7473E-02	.2941E-03	30.52	27.77
23.58	.924	6213	.9372E-02	.3690E-03	31.59	28.75
24.87	.979	6346	.1106E-01	.4356E-03	32.64	29.71

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	20.64	1.149	6536	.1509E-01	.5925E-03	33.92	33.86
	20.64	1.127	6639	.1352E-01	.5325E-03	35.09	31.93
	30.19	1.184	6753	.1514E-01	.5959E-03	36.13	32.84
	31.44	1.294	6863	.1862E-01	.7330E-03	37.26	33.91
	33.71	1.327	6903	.2211E-01	.8703E-03	38.53	35.06
	35.83	1.411	7059	.2803E-01	.1135E-02	39.63	36.06
	37.14	1.464	7106	.3508E-01	.1781E-02	40.46	36.82
F	38.48	1.515	7147	.3312E-01	.1303E-02	41.37	37.65
F	40.13	1.593	7193	.3913E-01	.1500E-02	42.36	38.55
F	41.66	1.640	7233	.5927E-01	.2337E-02	43.36	39.48
F	43.43	1.713	7263	.6773E-01	.2667E-02	44.57	40.56
F	44.47	1.791	7293	.1778E+00	.7003E-02	45.47	41.38
F	45.10	1.825	7294	.2563E+00	.1002E-01	46.34	41.99
F	47.62	1.873	7323	.6396E+00	.2402E-01	47.49	43.22
F	49.67	1.925	7334	.1051E+01	.6503E-01	49.49	45.04
F	51.07	2.125	7317	.1774E+01	.7030E-01	51.11	46.51
F	55.75	2.195	7311	.3911E+01	.1530E+00	52.91	48.25
F	59.56	2.745	7317				

TABLE D1-35

SPECIMEN NUMBER: U63-2L13
 ALLOY TYPE: 2024-T861
 SPECIMEN ORIENTATION: LONGITUDINAL
 CONSTRAINT: UNSTIFFENED
 ENVIRONMENT: WET AIR
 TEST TEMPERATURE: 302.0 K
 SPECIMEN THICKNESS: 1.63 MM (.0640 IN)
 MAXIMUM STRESS: 225.5 MPA (32.7 KSI)
 R-RATIO: .05
 FREQUENCY: 200 CPM
 CYCLES TO FAILURE: 654 CYCLES
 (MIN) 1 CYCLE PRIOR TO FAILURE 69.30 MPA SQRT(M) 63.06 KSI SQRT(IN)

CRACK LENGTH MM IN	CYCLES 1	DELTA (a)/DELTA (IN)		DELTA (STRESS INTENSITY)	
		MM/CYCLE	IN/CYCLE	MPA SQRT(M)	KSI SQRT(IN)
4.47	175	.8999E-02	.3543E-03	33.31	30.33
9.74	261	.9034E-02	.3558E-03	35.80	32.58
11.22	324	.1357E-01	.5323E-03	37.45	34.39
12.49	351	.1694E-01	.5860E-03	38.66	35.18
12.24	384	.2755E-01	.1084E-02	39.76	36.18
12.12	426	.1934E-01	.7120E-03	41.24	37.53
12.80	473	.1534E-01	.6257E-03	42.57	38.74
13.49	519	.2413E-01	.9503E-03	44.67	40.11
15.35	541	.5627E-01	.2215E-02	46.18	42.02
16.23	555	.6257E-01	.2464E-02	48.04	43.72
17.72	595	.3731E-01	.1469E-02	49.86	45.38
21.46	641	.8122E-01	.3198E-02	53.71	48.88
F	647	.2976E+00	.1172E-01	57.86	52.38
F	652	.2032E+00	.8000E-02	59.44	54.39
F	653	.4445E+01	.1750E+00	63.01	57.74

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TABLE D1-36

SPECIMEN NUMBER: ALLOY TYPE: SPECIMEN ORIENTATION: CONSTRAINT: ENVIRONMENT: TEST TEMPERATURE: SPECIMEN THICKNESS: MAXIMUM STRESS: R-RATIO: FREQUENCY: CYCLES TO FAILURE: K(MAX) 529 CYCLES PRIOR TO FAILURE:				U63-212 2024-T861 TRANSVERSE UNSTIFFENED WET AIR 302° K 1.65 MM (.0650 IN) 74.5 MPA (10.8 KSI) 200 CPM 40236 CYCLES 31.79 MPA SQRT(IN) 28.93 KSI SQRT(IN)			
CRACK LENGTH MM IN	CYCLES	DELTA (A)/DELTA (IN) MM/CYCLE IN/CYCLE	DELTA (STRESS INTENSITY) MPA SQRT(IN) KSI SQRT(IN)	DELTA (A)/DELTA (IN) MM/CYCLE IN/CYCLE	DELTA (STRESS INTENSITY) MPA SQRT(IN) KSI SQRT(IN)	DELTA (A)/DELTA (IN) MM/CYCLE IN/CYCLE	DELTA (STRESS INTENSITY) MPA SQRT(IN) KSI SQRT(IN)
6.82	.269	1	.1823E-03	.7166E-05	10.5	9.63	
7.38	.291	3079	.2514E-03	.9899E-05	11.08	10.09	
8.17	.322	6235	.1672E-03	.6583E-05	11.59	10.54	
8.82	.347	10086	.2811E-03	.1107E-04	12.08	10.99	
9.63	.379	12991	.3077E-03	.1211E-04	12.57	11.44	
10.33	.407	15249	.3614E-03	.1423E-04	13.01	11.84	
11.05	.435	17230	.3281E-03	.1292E-04	13.42	12.22	
11.69	.460	19193	.4376E-03	.1723E-04	13.81	12.56	
12.34	.486	20673	.4799E-03	.1889E-04	14.20	12.93	
13.07	.515	22208	.4938E-03	.1944E-04	14.58	13.27	
13.68	.539	23440	.4866E-03	.1916E-04	14.90	13.56	
14.24	.560	24578	.7056E-03	.2778E-04	15.34	13.96	
15.31	.603	26099	.6569E-03	.2586E-04	15.83	14.48	
16.09	.633	27290	.6831E-03	.2689E-04	16.19	14.73	
16.72	.658	28214	.9503E-03	.3741E-04	16.57	15.04	
17.41	.685	28933	.8832E-03	.3477E-04	16.85	15.33	
18.03	.710	29639	.9534E-03	.3754E-04	17.24	15.69	
19.02	.749	30682	.1255E-02	.4942E-04	17.81	16.21	
20.43	.804	31806	.1256E-02	.4944E-04	18.46	16.80	
21.78	.858	32881	.1536E-02	.6046E-04	19.15	17.43	
23.49	.925	33995	.1814E-02	.7219E-04	19.91	18.12	
25.26	.994	34940	.2313E-02	.9108E-04	20.62	18.76	
26.75	1.053	35598	.2924E-02	.1151E-03	21.27	19.36	
28.33	1.115	36140					
30.05	1.183	36754	.2807E-02	.1105E-03	21.96	19.98	
31.79	1.252	37238	.3592E-02	.1414E-03	22.67	20.63	
33.12	1.304	37598	.3694E-02	.1454E-03	23.29	21.19	
34.36	1.353	37856	.4809E-02	.1893E-03	23.88	21.66	
35.97	1.416	38192	.4793E-02	.1887E-03	24.37	22.18	
37.32	1.469	38455	.5099E-02	.2008E-03	24.95	22.71	
38.94	1.533	38682	.7161E-02	.2819E-03	25.54	23.24	
40.84	1.608	38886	.9295E-02	.3659E-03	26.23	23.87	
42.58	1.676	39086	.8706E-02	.3427E-03	26.93	24.51	
44.02	1.733	39268	.7934E-02	.3124E-03	27.56	25.08	
45.88	1.806	39412	.1309E-01	.5155E-03	28.20	25.66	
47.41	1.866	39533	.1244E-01	.4882E-03	28.86	26.26	
48.61	1.914	39612	.1519E-01	.5981E-03	29.39	26.75	
50.07	1.971	39736	.1569E-01	.6177E-03	29.91	27.22	

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TABLE D1-37

SPECIMEN NUMBER: ALLOY TYPE: SPECIMEN ORIENTATION: CONSTRAINT: ENVIRONMENT: TEST TEMPERATURE: SPECIMEN THICKNESS: MAXIMUM STRESS: R-RATIO: FREQUENCY: CYCLES TO FAILURE: K(MAX): 350 CYCLES PRIOR TO FAILURE:			U63-ST3 2024-T861 TRANVERSE UNSTRESS NET AIR 302° K 11.63 MM (1.064 IN) 110.6 MPA (15.8 KSI) 280 CPM 3701 CYCLES			
			33.96 MPA SQRT(M) (38.98 KSI SQRT(IN))			
CRACK LENGTH MM IN		CYCLES	DELTA (A)/DELTA (H) MM/CYCLE IN/CYCLE	DELTA (STRESS INTENSITY) MPA SQRT(M) KSI SQRT(IN)		
8.10	.319					
9.22	.363	753	.1490E-02	.5864E-04	18.63	16.96
10.05	.396	1224	.1753E-02	.6908E-04	19.66	17.89
10.89	.429	1585	.2996E-02	.1180E-03	20.58	18.66
11.57	.456	1779	.2480E-02	.9763E-04	21.24	19.33
12.30	.484	1978	.3670E-02	.1445E-03	21.91	19.94
13.03	.513	2191	.3405E-02	.1340E-03	22.58	20.55
13.76	.542	2350	.4641E-02	.1827E-03	23.23	21.14
14.54	.572	2487	.5664E-02	.2238E-03	23.90	21.75
15.33	.604	2607	.6619E-02	.2604E-03	24.57	22.36
16.11	.634	2732	.6208E-02	.2444E-03	25.22	22.95
17.00	.669	2862	.6848E-02	.2696E-03	25.90	23.57
17.73	.698	2931	.1055E-01	.4152E-03	26.54	24.16
18.57	.731	3007	.1113E-01	.4382E-03	27.16	24.72
19.38	.763	3871	.1260E-01	.4961E-03	27.40	25.38
20.59	.811	3169	.1232E-01	.4892E-03	28.56	25.99
21.94	.864	3270	.1342E-01	.5282E-03	29.50	26.85
23.40	.921	3353	.1826E-01	.7188E-03	30.51	27.77
25.17	.991	3425	.2359E-01	.9287E-03	31.65	28.68

TABLE D1-38

SPECIMEN NUMBER: ALLOY TYPE: SPECIMEN ORIENTATION: CONSTRAINT: ENVIRONMENT: TEST TEMPERATURE: SPECIMEN THICKNESS: MAXIMUM STRESS: R-RATIO: FREQUENCY: CYCLES TO FAILURE: K(MAX): 13 CYCLES PRIOR TO FAILURE:			U63-ST3 2024-T861 TRANVERSE UNSTRESS NET AIR 302° K 11.63 MM (1.064 IN) 198.7 MPA (28.8 KSI) 280 CPM 386 CYCLES			
			45.46 MPA SQRT(M) (41.37 KSI SQRT(IN))			
CRACK LENGTH MM IN		CYCLES	DELTA (A)/DELTA (H) MM/CYCLE IN/CYCLE	DELTA (STRESS INTENSITY) MPA SQRT(M) KSI SQRT(IN)		
6.74	.255					
7.57	.302	81	.1153E-01	.4538E-03	28.43	25.88
8.31	.327	123	.1539E-01	.6860E-03	29.95	27.26
9.02	.355	161	.1862E-01	.7329E-03	31.20	28.48
9.77	.384	191	.2485E-01	.9783E-03	32.50	29.57
10.57	.416	216	.3211E-01	.1264E-02	33.82	30.78
11.76	.463	241	.4780E-01	.1882E-02	35.47	32.28
12.89	.507	265	.4688E-01	.1846E-02	37.29	33.94
16.42	.646	293	.1261E+00	.4986E-02	48.73	37.87

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TABLE D1-39

SPECIMEN NUMBER: 63-313
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: STIFFENED
ENVIRONMENT: LAB AIR
TEST TEMPERATURE: 422.0 K
SPECIMEN THICKNESS: 1.61 MM (1.263 IN)
MAXIMUM STRESS: 117.2 MPA (17.0 KSI)
R-RATIO: .05
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 3886 CYCLES
K(MAX) AC CYCLES PRIOR TO FAILURE: 69.35 MPA SQRT(M) 53.12 KSI SQRT(IN)

CRACK LENGTH MM	IN	CYCLES	DELTA(A)/DELTA(H) MM/CYCLE	IN/CYCLE	DELTA(Stress Intensity) MPA SQRT(IN)	KSI SQRT(IN)
2.96	.117	1	.1195E-03	.4706E-05	11.59	10.54
3.91	.154	7821	.2195E-03	.8642E-05	12.98	11.81
4.73	.186	11541	.3008E-03	.1184E-04	14.06	12.79
5.40	.213	13767	.3470E-03	.1366E-04	14.95	13.60
6.05	.234	15646	.4395E-03	.1731E-04	15.76	14.35
6.88	.263	17062	.5903E-03	.2324E-04	16.50	15.02
7.26	.286	18063	.6857E-03	.2700E-04	17.23	15.68
7.93	.312	19039	.7369E-03	.2901E-04	17.93	16.32
8.52	.335	19837	.8173E-03	.3218E-04	18.61	16.94
9.19	.362	20659	.9109E-03	.3583E-04	19.37	17.63
9.98	.393	21534	.1664E-02	.6551E-04	20.17	18.36
10.78	.424	22011	.1123E-02	.4428E-04	20.85	18.98
11.40	.449	22563	.1647E-02	.6483E-04	21.51	19.58
12.15	.479	23035	.1683E-02	.6628E-04	22.10	20.11
12.89	.499	23336	.1591E-02	.6264E-04	22.64	20.60
13.34	.527	23775	.2313E-02	.9108E-04	23.22	21.13
14.00	.551	24044	.2064E-02	.8143E-04	23.73	21.60
14.50	.574	24324	.2527E-02	.9950E-04	24.29	22.11
15.34	.604	24625	.2891E-02	.1123E-03	24.91	22.67
16.34	.633	24882	.2658E-02	.1046E-03	25.52	23.22
16.85	.663	25173	.3651E-02	.1437E-03	26.10	23.75
17.55	.691	25365	.2593E-02	.1020E-03	26.65	24.26
18.26	.723	25646	.3040E-02	.1197E-03	27.16	24.71
18.86	.743	25839				
19.47	.767	26021	.3342E-02	.1316E-03	27.61	25.13
20.02	.780	26327	.4403E-02	.1734E-03	28.33	25.79
22.13	.871	26614	.4486E-02	.1766E-03	29.30	26.66
23.44	.923	26866	.5295E-02	.2089E-03	30.23	27.51
24.80	.976	27093	.5832E-02	.2296E-03	31.16	28.35
26.19	1.031	27339	.5784E-02	.2277E-03	32.09	29.21
27.61	1.087	27574	.6042E-02	.2379E-03	33.04	30.06
28.84	1.135	27769	.6317E-02	.2495E-03	33.91	30.86
30.05	1.183	27949	.6724E-02	.2647E-03	34.71	31.59
31.30	1.232	28128	.6953E-02	.2737E-03	35.50	32.31
32.60	1.283	28290	.8023E-02	.3157E-03	36.31	33.05
33.98	1.338	28452	.8529E-02	.3358E-03	37.16	33.82
35.28	1.389	28591	.9365E-02	.3687E-03	38.00	34.58
36.69	1.445	28741	.9423E-02	.3710E-03	38.85	35.35
37.95	1.494	28850	.1157E-01	.4555E-03	39.68	36.11
F 40.64	1.606	29056	.1304E-01	.5133E-03	40.89	37.22
F 42.67	1.680	29206	.1355E-01	.5333E-03	42.34	38.53
F 46.86	1.845	29506	.1397E-01	.5500E-03	44.25	40.27
F 48.64	1.915	29606	.1778E-01	.7008E-03	46.88	41.94
F 49.78	1.960	29706	.1143E-01	.4500E-03	46.99	42.76
F 51.31	2.020	29806	.1524E-01	.6000E-03	47.81	43.51
F 52.83	2.080	29906	.1524E-01	.6000E-03	48.76	44.38
F 55.24	2.175	30006	.2413E-01	.9500E-03	50.00	45.50
F 57.53	2.265	30106	.2206E-01	.8800E-03	51.49	46.86
F 60.45	2.380	30181	.3895E-01	.1533E-02	53.17	48.39
F 64.26	2.530	30331	.2540E-01	.1088E-02	55.40	50.41
F 66.93	2.635	30436	.3556E-01	.1400E-02	57.60	52.42
F 72.64	2.860	30501	.6616E-01	.2360E-02	60.56	55.11
F 76.83	3.025	30546	.9313E-01	.667E-02	64.25	58.47

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FRACTURE MECHANICS DATA FOR
2024-T8G1 AND 2124-T8G1

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TABLE D1-40

SPECIMEN NUMBER: 63-2L7						
ALLOY TYPE: 2124-T8G1						
SPECIMEN ORIENTATION: LONGITUDINAL						
CONSTRAINT: STIFFENED						
TEST ENVIRONMENT: LAB AIR						
TEST TEMPERATURE: 622.0 K						
SPECIMEN THICKNESS: 1.64 MM (0.0647 IN)						
MAXIMUM STRESS: 195.8 MPA (28.4 KSI)						
WAVELENGTH: 288 CPM						
CYCLES TO FAILURE: 3833 CYCLES						
K(MAX) 2 CYCLES PRIOR TO FAILURE: 78.17 MPA SQRT(M) (71.14 KSI SQRT(IN))						
CRACK LENGTH		CYCLES	DELTA(A)/DELTA(N)		DELTA(Stress Intensity)	
MM	IN		MM/CYCLE	IN/CYCLE	MPA SQRT(M)	KSI SQRT(IN)
2.65	.104	1	.6415E-03	.2603E-04	17.81	16.21
3.18	.125	780	.1503E-02	.5919E-04	19.56	17.82
3.85	.152	1226	.1563E-02	.6143E-04	21.29	19.37
4.47	.176	1624	.2115E-02	.8329E-04	22.96	21.09
5.21	.205	1971	.2544E-02	.1010E-03	24.57	22.36
5.84	.231	2231	.2873E-02	.1133E-03	25.93	23.60
6.47	.255	2437	.4023E-02	.1584E-03	27.18	24.74
7.13	.279	2692	.4433E-02	.1748E-03	28.29	26.74
7.58	.299	2703	.8001E-02	.3190E-03	29.99	26.93
8.46	.337	2813	.7235E-02	.2848E-03	30.97	28.19
9.11	.359	2912	.7460E-02	.2937E-03	32.15	29.26
9.82	.385	2997	.9642E-02	.3796E-03	33.93	31.08
11.07	.442	3144	.1439E-01	.5667E-03	35.68	32.47
12.11	.473	3194	.1035E-01	.4074E-03	36.65	33.36
12.57	.492	3245	.1936E-01	.6045E-03	37.65	34.27
13.74	.525	3313	.1658E-01	.6529E-03	38.90	35.40
14.27	.559	3352	.2416E-01	.9513E-03	40.17	36.55
15.12	.595	3433	.1671E-01	.6577E-03	41.11	37.41
15.56	.612	3416	.2413E-01	.9488E-03	42.07	38.29
16.55	.651	3457	.2264E-01	.8912E-03	43.25	39.38
17.37	.682	3491	.3040E-01	.1197E-02	44.05	40.09
17.77	.700	3506	.3841E-01	.1433E-02	44.90	40.87
18.64	.734	3533	.3305E-01	.1301E-02	46.29	42.13
19.87	.776	3573				
21.14	.834	3615	.3476E-01	.1369E-02	47.86	43.55
22.34	.880	3635	.3861E-01	.1523E-02	49.29	44.86
23.94	.944	3666	.5268E-01	.2074E-02	50.94	46.36
25.31	1.0136	3697	.7518E-01	.2963E-02	53.22	48.43
30.32	1.194	3741	.9118E-01	.3598E-02	56.75	51.64
33.07	1.332	3765	.1147E+00	.4517E-02	60.39	54.96
35.19	1.345	3776	.1926E+00	.7582E-02	62.96	57.30
36.53	1.438	3782	.2233E+00	.8792E-02	64.77	58.94
38.24	1.505	3787	.3414E+00	.1344E-01	66.35	60.38
39.91	1.571	3791	.4181E+00	.1646E-01	68.09	61.96
42.96	1.691	3797	.5542E+00	.2001E-01	70.51	64.17
45.10	1.776	3801	.5350E+00	.2106E-01	73.17	66.58

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2024-T861 AND 2124-T851

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TABLE D1-41

SPECIMEN NUMBER: 63-579
TEST TYPE: 2024-T861
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINTS: STIFFENED
ENVIRONMENT: 100% RH
TEST TEMPERATURE: 100°F
SPECIMEN THICKNESS: 1.65 MM (0.065 IN)
MAXIMUM STRESS: 117.2 MPA (17.0 KSI)
FREQUENCY: 280 CPM
CYCLES TO FAILURE: 22000 CYCLES
K(MAX): 19 CYCLES PRIOR TO FAILURE: 71.98 MPA SQR(M) (65.58 KSI SQR(IN))

CRACK LENGTH	MM	IN	CYCLES	DELTA(A)/DELTA(N)	DELTA(A)/DELTA(N)	DELTA(Δ)STRESS INTENSITY	MPA SQR(M)	KSI SQR(IN)
3.04	.120		1	.1337E-03	.9264E-05	11.43	10.48	
3.67	.144		4693	.2943E-03	.1150E-04	12.54	11.41	
4.40	.173		7179	.3054E-03	.1202E-04	13.47	12.26	
4.91	.193		8859	.4688E-03	.1846E-04	14.24	12.96	
5.49	.216		10097	.3878E-03	.1523E-04	15.02	13.67	
6.07	.239		11987	.6278E-03	.2469E-04	15.60	14.30	
6.72	.264		12622	.7169E-03	.2822E-04	16.59	15.10	
7.38	.290		13545	.8119E-03	.3196E-04	17.36	15.80	
8.04	.316		14360	.9187E-03	.3617E-04	18.09	16.47	
8.70	.343		15083	.1218E-02	.4797E-04	18.88	17.11	
9.36	.369		15625	.1302E-02	.5126E-04	19.49	17.73	
10.03	.395		16139	.1408E-02	.5544E-04	20.10	18.37	
10.76	.424		16654	.1973E-02	.7760E-04	20.86	18.98	
11.42	.450		16992	.2058E-02	.8101E-04	21.50	19.57	
12.13	.478		17337	.1648E-02	.6480E-04	22.05	20.07	
12.63	.497		17636	.2931E-02	.1154E-03	22.55	20.52	
13.25	.522		17847	.2694E-02	.1061E-03	23.19	21.11	
14.09	.555		18161	.2691E-02	.1059E-03	23.88	21.73	
14.84	.584		18439	.3426E-02	.1349E-03	24.56	22.35	
15.73	.619		18780	.3147E-02	.1239E-03	25.19	22.92	
16.37	.645		18933	.3948E-02	.1551E-03	25.84	23.52	
17.37	.684		19157	.4158E-02	.1636E-03	26.52	24.13	
18.11	.713		19333	.4349E-02	.1712E-03	27.09	24.65	
18.85	.742		19535	.5059E-02	.1992E-03	27.83	25.33	
20.08	.790		19747	.5779E-02	.2275E-03	28.60	26.21	
21.50	.847		19994	.5757E-02	.2267E-03	29.72	27.05	
22.63	.891		20189	.7051E-02	.2776E-03	30.59	27.84	
23.98	.944		20381	.7994E-02	.3147E-03	31.48	28.65	
25.20	.992		20534	.7988E-02	.3145E-03	32.37	29.46	
26.61	1.048		20713	.8459E-02	.3330E-03	33.28	30.29	
27.93	1.100		20866	.1189E-01	.4679E-03	34.17	31.10	
29.32	1.154		20983	.9689E-02	.3815E-03	35.07	31.92	
30.71	1.209		21126	.9351E-02	.3681E-03	35.92	32.69	
31.97	1.259		21261	.1030E-01	.4054E-03	36.75	33.44	
33.30	1.311		21390	.1328E-01	.5227E-03	37.58	34.20	
34.61	1.363		21489	.1438E-01	.5661E-03	38.53	35.07	
36.35	1.431		21610	.1280E-01	.5048E-03	39.48	35.92	
37.64	1.482		21711	.1761E-01	.6934E-03	40.41	36.77	
F 39.37	1.550		21809	.2159E-01	.8580E-03	41.60	37.86	
F 41.53	1.635		21989	.1905E-01	.7500E-03	42.85	38.99	
F 43.41	1.710		22009	.1905E-01	.7500E-03	44.02	40.06	
F 45.34	1.785		22189	.2413E-01	.9500E-03	45.34	41.26	
F 47.75	1.880		22209	.3302E-01	.1300E-02	47.11	42.87	
F 51.05	2.010		22309	.3175E-01	.1250E-02	49.12	44.70	
F 54.23	2.135		22409	.2540E-01	.1800E-02	50.93	46.35	
F 56.77	2.235		22509	.2794E-01	.1100E-02	52.19	47.50	
F 58.17	2.290		22559	.5842E-01	.2300E-02	53.59	48.77	
F 61.09	2.405		22609	.4318E-01	.1700E-02	55.27	50.30	
F 63.25	2.490		22659	.8346E-01	.3286E-02	56.99	51.87	
F 66.17	2.605		22694	.8128E-01	.3200E-02	58.71	53.43	
F 68.20	2.685		22719	.9144E-01	.3600E-02	60.25	54.83	
F 70.48	2.775		22744	.1609E+00	.6333E-02	61.96	56.39	
F 72.90	2.870		22759	.2413E+00	.9500E-02	64.71	58.89	
F 77.72	3.060		22779	.1963E+00	.7727E-02	67.49	61.42	
F 79.88	3.145		22793					

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TABLE D1-42

SPECIMEN NUMBER: 63-874
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: 100000
CONSTRAINT: 100000
ENVIRONMENT: 100000
TEST TEMPERATURE: 100000
SPECIMEN THICKNESS: 100000
MAXIMUM STRESS: 100000
R-RATIO: 100000
FREQUENCY: 100000
CYCLES TO FAILURE: 100000
N(MAX) 2 CYCLES PRIOR TO FAILURE: 58.37 MPA SQRTH(N) 93.12 KSI SQRTH(N)

CRACK LENGTH MM	IN	CYCLES	DELTA (A)/DELTA (N) MM/CYCLE	IN/CYCLE	DELTA (STRESS MPA SQRTH(N)	INTENSITY) KSI SQRTH(IN)
3.14	.124	1	.1441E-02	.5675E-04	19.47	17.72
3.83	.151	475	.2487E-02	.1827E-03	21.31	19.39
4.52	.178	739	.2818E-02	.1118E-03	22.89	20.83
5.11	.201	949	.5886E-02	.2286E-03	24.46	22.26
5.88	.231	1882	.4628E-02	.1618E-03	26.89	23.75
6.62	.261	1242	.7874E-02	.3188E-03	27.88	25.10
7.56	.298	1362	.8363E-02	.3293E-03	29.46	26.81
8.35	.329	1456	.1818E-01	.3978E-03	30.88	28.83
9.83	.355	1523	.1455E-01	.5727E-03	31.82	28.98
9.51	.374	1556	.1125E-01	.4427E-03	32.76	29.81
10.13	.399	1611	.1546E-01	.6886E-03	33.64	30.82
10.57	.416	1640	.1811E-01	.7129E-03	34.46	31.36
11.14	.438	1671	.1887E-01	.6326E-03	35.58	32.30
11.87	.468	1717	.2668E-01	.1847E-02	36.76	33.46
12.78	.503	1751	.1621E-01	.6388E-03	37.74	34.35
13.18	.519	1776	.2381E-01	.9375E-03	38.53	35.86
13.85	.545	1884	.2435E-01	.9588E-03	39.68	36.84
14.68	.578	1838	.2881E-01	.1118E-02	48.78	37.11
15.93	.611	1868	.4366E-01	.1719E-02	41.84	38.88
16.23	.639	1884	.5347E-01	.2185E-02	42.67	38.83
16.76	.668	1894	.6178E-01	.2432E-02	43.72	39.78
17.81	.781	1911	.7632E-01	.3885E-02	44.94	40.98
18.65	.734	1922	.9665E-01	.3885E-02	46.84	42.40
20.59	.818	1942	.1871E+00	.4217E-02	48.85	44.27
21.87	.861	1954	.1781E+00	.6931E-02	58.25	45.78
23.28	.917	1962	.3173E+00	.1249E-01	52.18	47.49
25.18	.991	1968	.3896E+00	.1534E-01	54.36	49.47
27.13	1.068	1973				

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TABLE D1-43

SPECIMEN NUMBER: U63-4L1
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
ENVIRONMENT: LAB AIR
TEST TEMPERATURE: 422.8 K
SPECIMEN THICKNESS: 1.65 MM (0.0650 IN)
MAXIMUM STRESS: 114.4 MPA (16.6 KSI)
R-RATIO: .85
FREQUENCY: 280 CPM
CYCLES TO FAILURE: 9829 CYCLES
K(MAX) 1 CYCLES PRIOR TO FAILURE: 66.83 MPA SQRT(M) (60.39 KSI SQRT(IN))

CRACK LENGTH MM IN	MM IN	CYCLES	DELTA(K)/DELTA(IN) MM/CYCLE IN/CYCLE	DELTA(Stress Intensity) MPA SQRT(M) KSI SQRT(IN)
9.24	.364	637	.9565E-03	.3766E-04
9.42	.391	1241	.1129E-02	.4429E-04
10.78	.425	1940	.1239E-02	.4864E-04
11.39	.444	2461	.1163E-02	.4578E-04
11.86	.467	2821	.1294E-02	.5111E-04
12.56	.495	3174	.1993E-02	.7847E-04
13.15	.518	3564	.1494E-02	.5897E-04
13.90	.547	3915	.2212E-02	.8710E-04
14.71	.579	4312	.1994E-02	.7850E-04
15.14	.612	4672	.2297E-02	.9042E-04
15.94	.624	4813	.2224E-02	.8757E-04
16.74	.659	5103	.3195E-02	.1258E-03
17.51	.689	5388	.2674E-02	.1053E-03
18.49	.728	5633	.3516E-02	.1384E-03
18.94	.746	5853	.2464E-02	.9701E-04
19.47	.776	6037	.4276E-02	.1656E-03
21.40	.842	6426	.4333E-02	.1708E-03
22.84	.899	6744	.4484E-02	.1766E-03
24.19	.953	7022	.4941E-02	.1945E-03
25.62	1.019	7261	.4072E-02	.2397E-03
26.78	1.054	7445	.5149E-02	.2419E-03
27.47	1.101	7673	.6873E-02	.2689E-03
29.73	1.167	7821	.6941E-02	.2736E-03
30.28	1.192	7954	.6844E-02	.2695E-03
32.13	1.261	8114	.7587E-02	.2987E-03
34.90	1.374	8411	.9273E-02	.3659E-03
35.48	1.417	8575	.1314E-01	.5175E-03
37.25	1.466	8634	.1067E-01	.4199E-03
38.20	1.504	8773	.1211E-01	.4766E-03
39.54	1.557	8837	.1121E-01	.4412E-03
40.59	1.614	8955	.1173E-01	.4547E-03
42.10	1.653	9143	.1593E-01	.6295E-03
43.28	1.714	9132	.1446E-01	.5631E-03
45.35	1.775	9247	.1775E-01	.7070E-03
46.44	1.828	9314	.1513E-01	.4979E-03
47.94	1.883	9402	.1951E-01	.7337E-03
48.98	1.924	9445	.2243E-01	.8987E-03
50.84	2.002	9523	.2397E-01	.9434E-03
51.48	2.046	9594	.3675E-01	.1447E-02
F	57.97	2.125	.4444E-01	.1746E-02
F	58.74	2.175	.2546E-01	.1000E-02

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F	57.51	2.765	9631	.5719E-01	.2250E-02	50.24	45.72
F	59.44	2.740	9712	.6350E-01	.2503E-02	51.56	46.92
F	63.84	2.515	9774	.5182E-01	.3182E-02	53.60	48.77
F	65.79	2.540	9794	.9525E-01	.3752E-02	55.69	50.58
F	67.94	2.175	9833	.1439E+00	.5667E-02	57.06	51.93
F	69.72	2.745	9819	.1778E+00	.7000E-02	58.42	53.16
F	71.37	2.917	9825	.2752E+00	.1003E-01	59.62	54.26
F	73.84	2.963	9827	.6393E+00	.2500E-01	60.67	55.21
F	74.82	2.945	9824	.2197E+01	.8500E-01	61.93	56.36

TABLE D1-44

SPECIMEN NUMBER: 2024-T861
SPECTION ORIGIN: MCDONNELL DOUGLAS
TEST ENVIRONMENT: 100% HUMIDITY
SPECTION TYPE: FRACTURE MECHANICS
MAXIMUM STRESS: 110.5 MPa (15.7 KSI)
FREQUENCY: 200 Hz
CYCLES TO FAILURE: 2000
N(MAX): 2 CYCLES PRIOR TO FAILURE
50.78 MPa SQRT(M) (53.48 KSI SQRT(IN))

CRACK LENGTH MM	CRACK LENGTH IN	CYCLES	DELTA (A)/DELTA (M) MM/CYCLE	DELTA (A)/DELTA (M) IN/CYCLE	DELTA (A)/DELTA (M) MM/CYCLE	DELTA (A)/DELTA (M) IN/CYCLE
8.45	.333	1	.1031E-02	.4059E-04	9.53	0.00
9.72	.383	1220	.1261E-02	.4963E-04	10.04	9.13
10.40	.410	1773	.1443E-02	.5682E-04	10.45	9.51
11.38	.449	2447	.2009E-02	.7909E-04	10.48	9.90
12.21	.481	2863	.2357E-02	.9279E-04	11.30	10.20
13.19	.519	3279	.2714E-02	.10567E-03	11.70	10.65
14.02	.552	3661	.3039E-02	.1197E-03	12.13	11.03
15.16	.597	4035	.3599E-02	.1417E-03	12.57	11.44
16.13	.635	4386	.3166E-02	.1248E-03	12.99	11.82
17.21	.678	4847	.5316E-02	.2093E-03	13.43	12.22
18.16	.721	4862	.4579E-02	.1803E-03	13.43	12.59
19.31	.750	5170	.6409E-02	.2523E-03	14.40	13.10
21.14	.842	5793	.8542E-02	.3363E-03	15.16	13.80
23.53	.929	5641	.8534E-02	.3360E-03	15.35	14.51
25.07	1.010	5919	.1054E-01	.4157E-03	16.75	15.24
26.19	1.110	6139	.1373E-01	.5400E-03	17.43	15.86
29.95	1.179	6267	.1439E-01	.5665E-03	18.02	16.40
31.86	1.254	6400	.1834E-01	.7222E-03	18.64	16.97
33.81	1.331	6506	.2059E-01	.8109E-03	19.23	17.50
35.58	1.401	6592	.2218E-01	.8733E-03	19.82	18.04
37.53	1.470	6680	.2800E-01	.1102E-02	20.41	18.50
39.38	1.550	6746	.2911E-01	.1146E-02	21.00	19.11
41.27	1.625	6811	.2789E-01	.1090E-02	21.53	19.59
42.81	1.685	6866	.2358E-01	.9250E-03	21.91	19.94
43.75	1.722	6906	.4060E-01	.2781E-02	22.60	20.57
F	47.24	6957	.4318E-01	.1700E-02	23.40	21.37
F	49.40	7007	.7197E-01	.2833E-02	24.15	21.98
F	51.56	7037	.4011E-01	.1579E-02	24.61	22.40
F	52.32	7056	.1123E+00	.4423E-02	25.20	22.93
F	55.24	7082	.1058E+00	.4167E-02	25.87	23.54
F	56.51	7094	.1397E+00	.5588E-02	26.38	23.94
F	57.91	7104	.9525E+00	.3752E-01	26.84	24.43
F	59.62	7186	.2288E+01	.9000E-01	27.54	25.86
F	62.10	7187				

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TABLE D1-45

SPECIMEN NUMBER: 63-1115
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: 1/2 PITCH
ENVIRONMENT: LAB AIR
TEST TEMPERATURE: 458.8 K
SPECIMEN THICKNESS: 1.54 MM (1/16 IN)
MAXIMUM STRESS: 117.2 MPA (17.0 KSI)
R-RATIO: 0.1
FREQUENCY: 2000 CPS
CYCLES TO FAILURE: 26231 CYCLES
K(MAX) 1917 CYCLES PRIOR TO FAILURE 41.41 MPA SQRT(M) (37.68 KSI SQRT(IN))

CRACK LENGTH MM	IN	CYCLES	DELTA (K)/DELTA (H) MM/CYCLE	DELTA (K)/DELTA (H) IN/CYCLE	DELTA (STRESS INTENSITY) MPA SQRT(M)	DELTA (STRESS INTENSITY) KSI SQRT(IN)
2.71	.107					
3.38	.133	5454	.1228E-03	.4885E-05	18.89	9.91
4.00	.158	8273	.2226E-03	.8762E-05	11.99	10.92
4.72	.186	10389	.3367E-03	.1326E-04	13.04	11.87
5.42	.213	12144	.3980E-03	.1567E-04	14.86	12.79
6.22	.245	13513	.5082E-03	.2316E-04	15.07	13.71
6.89	.271	14646	.5885E-03	.2317E-04	16.80	14.56
7.49	.295	15425	.7728E-03	.3042E-04	16.76	15.25
8.13	.320	16326	.7132E-03	.2008E-04	17.47	15.90
9.36	.368	17446	.1093E-02	.4371E-04	18.49	16.83
9.89	.389	17796	.1517E-02	.5971E-04	19.41	17.66
10.57	.416	18333	.1270E-02	.5008E-04	20.02	18.22
11.96	.432	18675	.1149E-02	.4522E-04	20.54	18.69
11.63	.458	19157	.1396E-02	.5498E-04	21.05	19.16
12.18	.480	19428	.2013E-02	.7915E-04	21.62	19.68
12.85	.506	19792	.1839E-02	.7239E-04	22.18	20.18
13.42	.528	20049	.2229E-02	.8774E-04	22.73	20.68
14.17	.558	20392	.2170E-02	.8542E-04	23.30	21.21
14.75	.581	20641	.2351E-02	.9257E-04	23.87	21.72
15.29	.602	20809	.3103E-02	.1253E-03	24.34	22.15
16.02	.631	21076	.2743E-02	.1081E-03	24.86	22.63
16.61	.656	21251	.3172E-02	.1249E-03	25.40	23.11
17.10	.673	21434	.2841E-02	.1118E-03	25.82	23.50
17.78	.700	21635	.3387E-02	.1333E-03	26.28	23.92
18.37	.723	21809	.3379E-02	.1330E-03	26.78	24.37
19.53	.769	22101	.4001E-02	.1575E-03	27.44	24.97
20.78	.818	22397	.4213E-02	.1699E-03	28.34	25.79
22.04	.868	22691	.4285E-02	.1687E-03	29.25	26.62
23.19	.913	22933	.4889E-02	.1893E-03	30.11	27.48
25.59	1.008	23358	.5614E-02	.2210E-03	31.34	28.52
26.97	1.062	23565	.6675E-02	.2628E-03	32.63	29.69
28.18	1.109	23738	.6952E-02	.2737E-03	33.49	30.47
29.22	1.150	23877	.7483E-02	.2946E-03	34.22	31.14
31.47	1.200	24027	.8365E-02	.3293E-03	34.97	31.82
31.62	1.245	24159	.8717E-02	.3432E-03	35.74	32.52
32.66	1.286	24289	.8881E-02	.3158E-03	36.44	33.16
33.76	1.329	24416	.8650E-02	.3486E-03	37.11	33.77
34.78	1.369	24516	.1017E-01	.4885E-03	37.78	34.38
35.88	1.413	24616	.1104E-01	.4345E-03	38.44	34.98
36.78	1.448	24714	.9123E-02	.3592E-03	39.06	35.55

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2024-T861 AND 2124-T851

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TABLE D1-46

SPECIMEN NUMBER: 63-614
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: STIFFENED
ENVIRONMENT: CAP AIR
TEST TEMPERATURE: 458.0 K
SPECIMEN THICKNESS: 1.63 MM (0.254 IN)
MAXIMUM STRESS: 195.8 MPA (28.4 KSI)
R-RATIO: 0.5
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 3451
K(MAX): 2 CYCLES PRIOR TO FAILURE: 93.72 MPA SQRT(M) (85.29 KSI SQRT(IN))

CRACK LENGTH MM IN	CYCLES	DELTA (A)/DELTA (N) MM/CYCLE IN/CYCLE	DELTA (STRESS) MPA SQRT(M)	INTENSITY KSI SQRT(IN)
2.75 .108	1	.1204E-02	.4742E-04	18.02
3.22 .127	344	.1497E-02	.5853E-04	19.67
3.90 .153	445	.1939E-02	.7633E-04	21.44
4.65 .179	1183	.2688E-02	.1058E-03	23.18
5.32 .209	1467	.3354E-02	.1320E-03	24.74
5.92 .233	1648	.3799E-02	.1492E-03	26.13
6.61 .260	1829	.4591E-02	.1807E-03	27.40
7.17 .282	1951	.4571E-02	.1799E-03	28.65
7.69 .302	2141	.5829E-02	.2295E-03	29.96
8.57 .337	2225	.6469E-02	.2547E-03	31.20
9.25 .365	2332	.7666E-02	.3018E-03	32.53
10.11 .398	2442	.7705E-02	.3034E-03	33.89
10.90 .429	2545	.8722E-02	.3426E-03	35.14
11.66 .459	2613	.9094E-02	.3576E-03	36.34
12.44 .490	2718	.1013E-01	.3907E-03	37.50
13.21 .520	2734	.1394E-01	.5134E-03	38.71
14.03 .554	2861	.1478E-01	.5821E-03	39.90
14.86 .585	2914	.1894E-01	.7316E-03	41.08
15.77 .621	2961	.1783E-01	.7021E-03	42.28
16.63 .655	3011	.2145E-01	.8444E-03	43.36
17.41 .685	3047	.2317E-01	.9083E-03	44.40
18.23 .718	3083	.2781E-01	.1095E-02	45.47
19.17 .751	3113	.2726E-01	.1173E-02	47.04
20.76 .817	3175			
21.46 .845	3221	.1569E-01	.6178E-03	48.51
23.59 .929	3251	.7477E-01	.2790E-02	50.19
25.14 .991	3275	.6213E-01	.2446E-02	52.33
26.85 1.057	3312	.4636E-01	.1814E-02	54.18
28.58 1.125	3338	.6698E-01	.2621E-02	56.09
31.78 1.212	3369	.7116E-01	.2832E-02	58.24
31.91 1.256	3381	.9366E-01	.3687E-02	60.02
32.97 1.298	3393	.5315E+00	.2092E-01	61.18
34.82 1.371	3430	.1423E+00	.5604E-02	62.72
36.11 1.422	3432	.2148E+00	.8458E-02	64.36
37.56 1.479	3438	.2411E+00	.9492E-02	65.78
39.06 1.538	3443	.2508E+00	.9875E-02	67.30
40.96 1.613	3453	.2114E+00	.8322E-02	69.05
42.84 1.675	3459	.2635E+00	.1037E-01	70.84
44.65 1.758	3454	.4214E+00	.1659E-01	72.72
46.27 1.825	3459	.3429E+00	.1351E-01	74.68
48.75 1.919	3445	.3973E+00	.1564E-01	76.79
51.42 2.025	3451	.5344E+00	.2104E-01	79.40
54.44 2.143	3454	.7544E+00	.2970E-01	82.37
59.18 2.331	3459	.9482E+00	.3733E-01	86.48

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TABLE D1-47

SPECIMEN NUMBER: 61-3712
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINT: STRESS
ENVIRONMENT: LAB AIR
TEST TEMPERATURE: 68.0 K
SPECIMEN THICKNESS: 1.53 MM (0.060 IN)
MAXIMUM STRESS: 117.2 MPA (17.0 KSI)
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 2688
K(MAX): 638 CYCLES PRIOR TO FAILURE: 44.86 MPA SQRT(M) (48.18 KSI SQRT(IN))

CRACK LENGTH MM	IN	CYCLES	DELTA (A)/DELTA (N) MM/CYCLE	IN/CYCLE	DELTA (STRESS INTENSITY) MPA SQRT(M)	KSI SQRT(IN)
3.13	.123	1	.1484E-03	.5842E-05	11.56	18.52
3.73	.147	4032	.1329E-03	.5234E-05	12.39	11.28
4.15	.163	7213	.1508E-03	.1381E-04	13.29	12.10
4.91	.193	9345	.2699E-03	.1062E-04	14.25	12.97
5.50	.217	11578	.4739E-03	.1866E-04	15.12	13.76
6.21	.244	13060	.6007E-03	.2365E-04	15.97	14.54
6.86	.270	14153	.8881E-03	.2789E-04	16.82	15.31
7.62	.300	15251	.7456E-03	.2933E-04	17.63	16.05
8.29	.326	16148	.1053E-02	.4144E-04	18.31	16.87
8.86	.349	16697	.1048E-02	.4124E-04	18.99	17.28
9.56	.377	17365	.1548E-02	.6093E-04	19.71	17.94
10.28	.405	17827	.1343E-02	.5289E-04	20.34	18.51
10.84	.427	18242	.2019E-02	.7947E-04	20.96	19.07
11.56	.455	18600	.1841E-02	.7246E-04	21.64	19.69
12.28	.484	18994	.2184E-02	.8598E-04	22.32	20.31
13.05	.514	19347	.3159E-02	.1244E-03	22.88	20.82
13.55	.534	19505	.2615E-02	.1030E-03	23.42	21.31
14.33	.563	19791	.3091E-02	.1217E-03	24.03	21.87
15.00	.591	20017	.2941E-02	.1158E-03	24.61	22.39
15.68	.617	20240	.3477E-02	.1369E-03	25.23	22.96
16.53	.651	20492	.3602E-02	.1418E-03	25.93	23.59
17.43	.686	20742	.4272E-02	.1682E-03	26.61	24.21
18.27	.719	20940	.4263E-02	.1678E-03	27.23	24.78
19.06	.751	21125	.5624E-02	.2214E-03	28.84	25.52
20.43	.804	21368	.5540E-02	.2181E-03	28.96	26.36
21.58	.849	21575	.5637E-02	.2219E-03	29.90	27.21
23.05	.908	21837	.7593E-02	.2989E-03	30.91	28.13
24.47	.963	22023	.7776E-02	.3061E-03	31.96	29.08
26.11	1.028	22235	.8890E-02	.3500E-03	33.58	30.56
29.31	1.154	22595	.1114E-01	.4386E-03	35.12	31.96
30.83	1.214	22731	.1281E-01	.5045E-03	36.10	32.85
32.39	1.275	22853	.1359E-01	.5333E-03	37.11	33.77
34.02	1.339	22973	.1474E-01	.5884E-03	38.25	34.81
36.01	1.418	23108	.1559E-01	.6137E-03	39.32	35.79
37.49	1.476	23203	.1726E-01	.6797E-03	40.27	36.65
39.06	1.538	23294	.1657E-01	.7309E-03	41.31	37.59
42.86	1.689	23391				

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TABLE D1-48

SPECIMEN NUMBER: 63-1T1
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: T861-1T1
CONSTRAINT: STIFFENED
ENVIRONMENT: LAB AIR
TEST TEMPERATURE: 69.0 K
SPECIMEN THICKNESS: 1.63 MM (0.064 IN)
MAXIMUM STRESS: 199.8 MPA (28.4 KSI)
R-RATIO: 288
FREQUENCY: 2017 CYCLES
CYCLES TO FAILURE: 60.98 MPA SQRT(M) (55.49 KSI SQRT(IN))
K(MAX) & CYCLES PRIOR TO FAILURE:

CRACK LENGTH		CYCLES	DELTA(K)/DELTA(N)		DELTA(Stress Intensity)	
MM	IN		MM/CYCLE	IN/CYCLE	MPA SQRT(M)	KSI SQRT(IN)
3.21	.126	1	.2321E-02	.9136E-04	19.05	10.06
4.03	.159	354	.3999E-02	.1574E-03	21.83	19.07
4.73	.186	529	.4244E-02	.1671E-03	23.51	21.40
5.43	.214	693	.5786E-02	.2278E-03	25.22	22.96
6.26	.246	837	.7274E-02	.2864E-03	26.94	24.51
7.06	.278	947	.6437E-02	.2534E-03	28.04	26.24
8.19	.323	1123	.7601E-02	.2993E-03	30.36	27.63
8.70	.343	1190	.1009E-01	.3973E-03	32.13	29.24
10.21	.402	1339	.1093E-01	.4304E-03	34.67	31.95
11.77	.463	1482	.2140E-01	.8456E-03	36.47	33.19
12.50	.492	1516	.1408E-01	.5535E-03	37.47	34.18
13.10	.516	1559	.1719E-01	.6769E-03	38.41	34.96
13.77	.542	1598	.1822E-01	.7175E-03	39.42	35.67
14.50	.571	1638	.1889E-01	.7436E-03	40.45	36.01
15.24	.600	1677	.2078E-01	.8190E-03	41.93	37.00
16.07	.633	1717	.2216E-01	.8726E-03	42.55	38.73
16.76	.660	1748	.2578E-01	.1015E-02	43.57	39.65
17.61	.693	1781	.6587E-01	.2562E-02	45.80	40.96
18.97	.747	1802	.2281E-01	.8979E-03	46.21	42.06
19.52	.769	1824	.2499E-01	.9837E-03	47.17	42.93
20.52	.800	1866	.3371E-01	.1327E-02	48.50	44.14
21.70	.854	1901	.4678E-01	.1839E-02	50.07	45.57
23.15	.911	1932	.5234E-01	.2061E-02	51.77	47.11
24.61	.969	1968	.7874E-01	.3100E-02	53.55	48.73
26.27	1.034	1981	.9532E-01	.3753E-02	55.49	50.50
28.08	1.105	2000	.1020E+00	.4015E-02	57.21	52.06
29.40	1.158	2813				

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TABLE D1-49

SPECIMEN NUMBER: 63-111
SPLIT ORIENTATION: 2024-T861
CONSTRAINT: 51100 INCHES
ENVIRONMENT: LAB AIR
TEST TEMPERATURE: 200 K
SPECIMEN THICKNESS: 1.54 MM (1.54 IN)
MAXIMUM STRESS: 117.2 MPa (17.0 KSI)
FREQUENCY: 200 CPS
CYCLES TO FAILURE: 78978
K(MAX) 10 CYCLES PRIOR TO FAILURE: 80.15 MPa SQRT(M) 72.94 KSI SQRT(IN)

CRACK LENGTH MM	IN	CYCLES I	DELTA (A)/DELTA (N) MM/CYCLE	IN/CYCLE	DELTA (STRESS MPa SQRT(M)	INTENSITY KSI SQRT(IN)
3.16	.124					
3.90	.154	11664	.6368E-04	.2547E-05	6.18	5.62
4.68	.194	21029	.8289E-04	.3264E-05	6.81	6.20
5.41	.213	27136	.1184E-03	.4661E-05	7.38	6.72
6.07	.239	32547	.1225E-03	.4827E-05	7.88	7.17
6.67	.263	36485	.1542E-03	.6389E-05	8.30	7.55
7.37	.290	40283	.1839E-03	.7241E-05	8.72	7.93
7.98	.314	43331	.1984E-03	.7811E-05	9.11	8.29
8.53	.336	45907	.2169E-03	.8459E-05	9.45	8.60
9.41	.376	49399	.2517E-03	.9908E-05	9.86	8.97
10.11	.398	51752	.2963E-03	.1167E-04	10.29	9.36
11.01	.434	54117	.3829E-03	.1507E-04	10.71	9.74
11.01	.465	56015	.4215E-03	.1660E-04	11.14	10.13
12.45	.490	57456	.4433E-03	.1745E-04	11.49	10.45
13.14	.518	58851	.4955E-03	.1951E-04	11.88	10.74
13.84	.545	60106	.5597E-03	.2204E-04	12.13	11.04
14.54	.572	61047	.7696E-03	.3030E-04	12.44	11.32
15.18	.597	62004	.6423E-03	.2524E-04	12.74	11.59
15.82	.623	62787	.8191E-03	.3225E-04	13.02	11.85
16.42	.646	63453	.8923E-03	.3512E-04	13.28	12.09
16.99	.669	64094	.8967E-03	.3528E-04	13.53	12.31
17.66	.695	64643	.1228E-02	.4836E-04	13.79	12.55
18.27	.719	65174	.1153E-02	.4529E-04	14.05	12.79
18.65	.734	65527	.1383E-02	.4263E-04	14.25	12.97
20.02	.788	66684	.1178E-02	.4637E-04	14.60	13.28
21.81	.859	68050	.1314E-02	.5172E-04	15.21	13.84
23.21	.914	69021	.1427E-02	.5619E-04	15.81	14.39
24.68	.969	69715	.2033E-02	.8006E-04	16.32	14.85
26.02	1.024	70439	.1961E-02	.7722E-04	16.83	15.31
27.25	1.073	71054	.1988E-02	.7825E-04	17.30	15.74
28.62	1.127	71619	.2443E-02	.9617E-04	17.75	16.15
29.94	1.179	72134	.2696E-02	.1041E-03	18.21	16.57
31.35	1.234	72628	.2709E-02	.1066E-03	18.67	16.99
32.93	1.296	73111	.3266E-02	.1286E-03	19.18	17.45
34.34	1.352	73591	.2947E-02	.1160E-03	19.67	17.90
35.75	1.408	74012	.3348E-02	.1318E-03	20.14	18.33
37.09	1.460	74336	.4135E-02	.1628E-03	20.59	18.74
38.36	1.510	74663	.4173E-02	.1643E-03	21.01	19.12
39.78	1.566	74981	.4153E-02	.1635E-03	21.45	19.52
41.14	1.620	75257	.4924E-02	.1938E-03	21.90	19.93
42.35	1.667	75518	.4837E-02	.1904E-03	22.31	20.31
43.85	1.727	75761	.5938E-02	.2338E-03	22.75	20.71
44.98	1.771	75986	.5012E-02	.1973E-03	23.18	21.09
46.21	1.819	76163	.6967E-02	.2743E-03	23.56	21.44
47.33	1.863	76353	.5855E-02	.2395E-03	23.94	21.78
F	49.40	1.945	.9229E-02	.3633E-03	24.45	22.25
F	50.93	2.015	.4354E-02	.1714E-03	25.04	22.79
F	53.09	2.090	.4636E-02	.3400E-03	25.65	23.36
F	56.26	2.215	.1279E-01	.5080E-03	26.53	24.14
F	58.84	2.285	.8890E-02	.3580E-03	27.36	24.90
F	61.72	2.430	.1842E-01	.7250E-03	28.30	25.75
F	64.39	2.535	.1333E-01	.5250E-03	29.41	26.76
F	66.91	2.595	.1016E-01	.4080E-03	30.16	27.45
F	67.18	2.645	.1270E-01	.5080E-03	30.67	27.91
F	69.09	2.720	.1905E-01	.7580E-03	31.26	28.44
F	71.25	2.885	.3084E-01	.1214E-02	32.82	29.14
			.1089E-01	.4286E-03	32.59	29.66

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F	72.01	2.035	70510	.1915E-01	.7057E-03	33.01	30.04
F	73.41	2.090	70500	.3266E-01	.1206E-02	33.75	30.71
F	75.09	2.900	70650	.3179E-01	.1250E-02	34.01	31.49
F	77.60	3.055	70710	.2320E-01	.9167E-03	35.30	32.13
F	78.99	3.110	70770	.5334E-01	.2100E-02	36.19	32.93
F	81.06	3.215	70820	.2794E-01	.1199E-02	37.10	33.76
F	83.06	3.270	70870	.2206E-01	.9000E-03	37.09	34.30
F	84.20	3.315	70920	.7620E-01	.3600E-02	36.23	34.79
F	85.34	3.360	70943	.6905E-01	.2790E-02	38.04	35.34
F	86.74	3.415	70963	.3994E-01	.1400E-01	39.62	36.06
F	88.52	3.485	70960				

TABLE D1-50

SPECIMEN NUMBER			62-2115		
SPECIMEN ORIENTATION			LONGITUDINAL		
ENVIRONMENT			1.54 MM (1.54 MM)		
TEST TEMPERATURE			190.0 MPa (28.0 KSI)		
SPECIMEN THICKNESS			12732 CYCLES		
MAXIMUM STRESS			12732 CYCLES		
FREQUENCY			12732 CYCLES		
CYCLES TO FAILURE			12732 CYCLES		
K(MAX)			12732 CYCLES		
1 CYCLES PRIOR TO FAILURE			(NET STRESS GREATER THAN 0.9 FTY)		

CRACK LENGTH	IN	CYCLES	DELTA(A)/DELTA(N)	DELTA(STRSS INTENSITY)	
MM	IN		MM/CYCLE	NPA SORTIM	MSI SORTIM
3.13	.123		.3215E-03	.1266E-04	10.10 9.27
3.76	.148	1964	.3727E-03	.1467E-04	11.11 10.11
4.44	.175	3794	.5374E-03	.2116E-04	11.96 11.00
5.05	.199	4926	.6704E-03	.2671E-04	12.90 11.74
5.98	.235	6302	.8431E-03	.3319E-04	13.77 12.53
6.99	.259	7019	.1045E-02	.4272E-04	14.49 13.19
7.32	.288	7699	.1962E-02	.7726E-04	15.14 13.77
7.85	.309	7965	.2193E-02	.9621E-04	15.72 14.30
8.51	.335	8266	.2379E-02	.9360E-04	16.32 14.85
9.11	.359	8519	.2330E-02	.9174E-04	16.96 15.43
9.90	.390	8858	.2536E-02	.9904E-04	17.66 16.07
10.70	.421	9174	.1964E-02	.7733E-04	18.25 16.61
11.29	.444	9474	.4740E-02	.1869E-03	18.84 17.14
12.10	.477	9646	.4257E-02	.1676E-03	19.42 17.67
12.72	.501	9791	.4960E-02	.1956E-03	19.94 18.19
13.45	.530	993	.3603E-02	.1419E-03	20.45 18.61
14.05	.553	10134	.4447E-02	.1735E-03	20.96 19.07
14.79	.582	10272	.4863E-02	.1915E-03	21.4 19.52
15.34	.614	10395	.4393E-02	.1730E-03	21.73 19.91
15.94	.629	10530	.7324E-02	.2804E-03	22.39 20.38
16.83	.663	10646	.6210E-02	.2445E-03	22.90 20.92
17.68	.696	10792	.4925E-02	.1939E-03	23.46 21.15
18.24	.718	10897	.6426E-02	.2530E-03	23.87 21.72
18.88	.743	10997			

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	20.24	.797	11155	.0560E-02	.3373E-03	24.53	22.32
	21.41	.841	11283	.9240E-02	.3638E-03	25.35	23.37
	22.80	.898	11432	.9246E-02	.3640E-03	26.15	23.86
	24.23	.954	11551	.1108E-01	.4360E-03	27.02	24.59
	25.58	1.007	11642	.1116E-01	.4393E-03	27.86	25.36
	27.15	1.065	11749	.1377E-01	.5421E-03	28.70	26.12
F	28.63	1.121	11841	.1512E-01	.5942E-03	29.72	26.64
F	30.11	1.175	11917	.1777E-01	.7451E-03	30.20	27.48
F	31.50	1.240	12052	.1777E-01	.6500E-03	31.24	28.47
F	33.40	1.315	12142	.2117E-01	.8333E-03	32.20	29.31
F	35.31	1.370	12222	.2381E-01	.9375E-03	33.26	30.27
F	37.08	1.460	12292	.2540E-01	.1000E-02	34.27	31.19
F	39.02	1.560	12367	.3629E-01	.1429E-02	35.44	32.25
F	40.64	1.655	12437	.3447E-01	.1357E-02	36.78	33.47
F	43.81	1.725	12492	.2963E-01	.1167E-02	37.91	34.50
F	45.47	1.790	12542	.3302E-01	.1300E-02	38.83	35.34
F	47.37	1.865	12586	.4313E-01	.1705E-02	39.79	36.21
F	50.16	1.975	12622	.7761E-01	.3056E-02	41.07	37.37
F	52.20	2.155	12652	.6771E-01	.2667E-02	42.38	38.57
F	54.36	2.140	12677	.8636E-01	.3400E-02	43.54	39.62
F	57.39	2.220	12697	.1016E+00	.4000E-02	44.70	40.68
F	58.95	2.320	12712	.1693E+00	.6667E-02	45.99	41.85
F	62.10	2.445	12720	.3969E+00	.1563E-01	47.63	43.34
F	64.90	2.555	12724	.6985E+00	.2750E-01	49.38	44.94
F	67.18	2.645	12726	.5715E+00	.2250E-01	50.91	46.33
F	67.94	2.675	12730				
F	68.83	2.710	12731				

(NET STRESS GREATER THAN 3.9 FTY)

(NET STRESS GREATER THAN 0.9 FTY)

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TABLE D1-51

SPECIMEN NUMBER: 63-477
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINT: STIFFENED
ENVIRONMENT: LAB AIR
TEST TEMPERATURE: 450.0 K
SPECIMEN THICKNESS: 1.56 MM (0.061 IN)
MAXIMUM STRESS: 118.5 MPA (17.2 KSI)
R-RATIO: 0.0
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 23718 CYCLES
K(MAX) 20 CYCLES PRIOR TO FAILURE: 67.71 MPA SQRT(M) (61.62 KSI SQRT(IN))

CRACK LENGTH MM	CRACK LENGTH IN	CYCLES	DELTA (A)/DELTA (H) MM/CYCLE	DELTA (A)/DELTA (H) IN/CYCLE	DELTA (STRESS INTENSITY) MPA SQRT(M)	DELTA (STRESS INTENSITY) KSI SQRT(IN)
9.13	.359	1	.2931E-03	.1154E-04	10.24	9.32
9.80	.386	2293	.4100E-03	.1633E-04	10.61	9.66
10.50	.413	3977	.4596E-03	.1809E-04	11.09	10.09
11.63	.458	6442	.6869E-03	.2704E-04	11.56	11.52
12.40	.488	7555	.4858E-03	.1913E-04	11.88	11.81
12.95	.510	8687	.6113E-03	.2406E-04	12.08	10.99
13.25	.522	9190	.8345E-03	.3285E-04	12.33	11.22
14.00	.551	10091	.9359E-03	.3684E-04	12.72	11.57
14.97	.589	11121	.1119E-02	.4404E-04	13.16	11.98
16.01	.630	12052	.1191E-02	.4688E-04	13.68	12.45
17.38	.684	13206	.1264E-02	.4975E-04	14.17	12.90
18.39	.724	14001	.1496E-02	.5891E-04	14.59	13.28
19.43	.765	14697	.1607E-02	.6326E-04	15.06	13.70
20.75	.817	15519	.1979E-02	.7791E-04	15.60	14.19
22.21	.874	16257	.2388E-02	.9402E-04	16.13	14.68
23.57	.928	16826	.2168E-02	.8536E-04	16.72	15.22
25.44	1.002	17693	.2916E-02	.1148E-03	17.35	15.79
27.03	1.064	18234	.2780E-02	.1094E-03	17.90	16.29
28.59	1.126	18795	.3349E-02	.1318E-03	18.43	16.77
30.05	1.183	19233	.3289E-02	.1295E-03	18.98	17.27
31.79	1.251	19759	.4243E-02	.1670E-03	19.56	17.80
33.44	1.310	20158	.5144E-02	.2025E-03	20.13	18.32
35.22	1.387	20497	.5776E-02	.2274E-03	20.70	18.84
36.91	1.453	20789	.6344E-02	.2498E-03	21.40	19.48
39.48	1.554	21194	.6253E-02	.2462E-03	22.17	20.18
41.60	1.638	21534	.7119E-02	.2803E-03	22.87	20.81
43.77	1.723	21839	.9335E-02	.3675E-03	23.43	21.32
45.02	1.772	21972	.7695E-02	.3029E-03	23.95	21.80
46.98	1.850	22227	.1054E-01	.4164E-03	24.48	22.28
48.24	1.899	22346	.1008E-01	.3960E-03	25.02	22.77
50.25	1.978	22546	.1148E-01	.4513E-03	25.57	23.27
51.57	2.022	22661	.1115E-01	.4389E-03	26.20	23.85
54.09	2.129	22887	.1112E-01	.4771E-03	26.82	24.41
55.23	2.174	22981	.1543E-01	.6074E-03	27.37	24.90
57.33	2.257	23117	.525E-01	.5983E-03	27.96	25.44
58.68	2.310	23206	.1278E-01	.5038E-03	28.45	25.89
60.15	2.368	23322	.1825E-01	.7186E-03	28.98	26.37
F 61.72	2.438	23408	.1651E-01	.6508E-03	29.55	26.89
F 63.37	2.495	23504	.2543E-01	.1000E-02	30.12	27.41
F 64.90	2.555	23564	.4445E-01	.1750E-02	30.89	28.11
F 67.56	2.663	23628	.2458E-01	.1125E-02	31.60	28.76
F 68.71	2.705	23664	.2159E+00	.8500E-02	32.23	29.33
F 70.87	2.790	23678	.7623E-01	.3000E-02	32.79	29.84
F 71.63	2.820	23698	.2286E+00	.9000E-02	33.40	30.39
F 73.91	2.910	23718				

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TABLE D1-52

SPECIMEN NUMBER: 63-310
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: 57233-1000
CONSTRAINTS: 57233-1000
ENVIRONMENT: LAB AIR
TEST TEMPERATURE: 650.0 K
SPECIMEN THICKNESS: 1.52 MM (1.630 IN)
MAXIMUM STRESS: 195.8 MPA (28.4 KSI)
R-RATIO: 280 CEN
FREQUENCY: 8233 CYCLES
CYCLES TO FAILURE: 74.19 MPA SQRT(IN) (67.91 KSI SQRT(IN))
K(MAX) 1 CYCLES PRIOR TO FAILURE

CRACK LENGTH	IN	MM	DELTA(A)/DELTA(B)	IN/CYCLE	DELTA(Stress Intensity)	MPA SQRT(IN)	KSI SQRT(IN)
CYCLES	1	1	MM/CYCLE	1	1	1	1
2.89	.114	1782	.3366E-03	.1325E-04	9.81	8.93	
3.49	.138	2776	.6363E-03	.2505E-04	10.71	9.75	
4.12	.162	3536	.9499E-03	.3748E-04	11.61	10.57	
4.82	.190	4088	.1026E-02	.6038E-04	12.42	11.38	
5.42	.213	4523	.1341E-02	.5278E-04	13.12	11.94	
5.99	.236	4927	.1782E-02	.7015E-04	13.85	12.68	
6.72	.265	5317	.1892E-02	.7449E-04	14.63	13.31	
7.46	.294	5553	.2711E-02	.1075E-03	15.33	13.95	
8.69	.319	5807	.2046E-02	.8094E-04	15.89	14.46	
8.62	.339	6036	.3793E-02	.1493E-03	16.99	15.06	
9.49	.374	6339	.3259E-02	.1283E-03	17.38	15.82	
10.47	.412	6474	.3492E-02	.1379E-03	18.81	16.39	
10.95	.431	6584	.6512E-02	.2564E-03	18.52	16.85	
11.66	.459	6742	.4622E-02	.1820E-03	19.11	17.39	
12.39	.488	6943	.4971E-02	.1957E-03	19.79	18.01	
13.38	.527	7096	.6123E-02	.2409E-03	20.44	18.60	
14.69	.555	7127	.7244E-02	.2852E-03	20.90	19.02	
14.60	.575	7215	.7533E-02	.2966E-03	21.34	19.42	
15.27	.601	7336	.9100E-02	.3583E-03	21.98	20.00	
16.37	.644	7415	.8295E-02	.3266E-03	22.60	20.56	
17.62	.673	7495	.8128E-02	.3200E-03	23.05	20.97	
17.67	.696	7542	.1451E-01	.5713E-03	23.50	21.39	
18.35	.723	7620	.1021E-01	.4051E-03	24.00	21.84	
19.16	.754	7735	.1208E-01	.4748E-03	24.72	22.58	
20.54	.909	7825	.1840E-01	.7244E-03	25.69	23.38	
22.20	.874	7868	.2740E-01	.1079E-02	26.51	24.13	
23.16	.912	7923	.1341E-01	.5278E-03	27.67	24.63	
F 24.05	.945	7993	.2359E-01	.9266E-03	27.82	25.32	
F 25.65	1.010	8053	.2963E-01	.1167E-02	28.84	26.24	
F 27.43	1.080	8103	.3048E-01	.1280E-02	29.80	27.12	
F 28.96	1.143	8143	.3810E-01	.1500E-02	30.67	27.91	
F 30.40	1.203	8173	.2961E-01	.1167E-02	31.35	28.53	
F 31.37	1.235	8188	.1101E+00	.4333E-02	32.86	29.18	
F 33.92	1.330	9203	.1947E+00	.7667E-02	33.33	30.33	
F 35.94	1.415	8218	.1185E+00	.4667E-02	34.62	31.50	
F 37.72	1.485	8232	.2631E+00	.1036E-01	36.10	32.85	
F 41.40	1.630						

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TABLE D1-53

SPECIMEN NUMBER:	U63-3L4
ALLOY TYPE:	2024-T861
SPECIMEN ORIENTATION:	LONGITUDINAL
CONSTRAINT:	UNSTIFFENED
ENVIRONMENT:	LAB AIR
TEST TEMPERATURE:	455.0 K
SPECIMEN THICKNESS:	1.60 MM (.0630 IN)
MAXIMUM STRESS:	119.6 MPA (17.2 KSI)
R-RATIO:	.35
FREQUENCY:	200 CPM
CYCLES TO FAILURE:	9606 CYCLES
K1 MAX: 428 CYCLES PRIOR TO FAILURE:	49.36 MPA SQRT(IN) (44.92 KSI SQRT(IN))

CRACK LENGTH MM IN	CYCLES	DELTA(A1)/DELTA(A2) MM/CYCLE IN/CYCLE		DELTA(STRESS INTENS.) MPA SQRT(IN) KSI SQRT(IN)	
		MM/CYCLE	IN/CYCLE	MPA SQRT(IN)	KSI SQRT(IN)
9.09	1051	.689E-03	.2714E-04	18.90	17.25
11.03	1691	.1149E-02	.4603E-04	19.67	17.70
11.92	2413	.1271E-02	.4809E-04	20.49	18.65
11.75	2972	.1831E-02	.7090E-04	21.33	19.41
12.77	3413	.1865E-02	.7341E-04	22.19	20.26
13.54	3841	.1934E-02	.7512E-04	23.02	20.95
15.49	4633	.2422E-02	.9536E-04	24.20	22.03
16.77	5071	.2933E-02	.1145E-03	25.53	23.24
17.95	5513	.2828E-02	.1135E-03	26.52	24.13
18.99	5802	.3693E-02	.1454E-03	27.38	24.92
20.49	6143	.4449E-02	.1751E-03	28.35	25.80
22.21	6523	.4533E-02	.1785E-03	29.55	26.89
23.51	6782	.4938E-02	.1944E-03	30.63	27.88
25.40	7079	.6359E-02	.2507E-03	31.74	28.89
26.99	7339	.6216E-02	.2447E-03	32.93	29.97
29.05	7601	.7758E-02	.3055E-03	34.16	31.09
30.59	7802	.7664E-02	.3017E-03	35.35	32.17
32.44	8022	.8663E-02	.3411E-03	36.46	33.18
33.61	8173	.7501E-02	.2953E-03	37.42	34.06
35.84	8371	.1102E-01	.4337E-03	38.49	35.03
37.15	8504	.9975E-02	.3927E-03	39.61	36.04
39.39	8675	.1307E-01	.5146E-03	40.71	37.05
41.79	8769	.1512E-01	.5952E-03	41.85	38.08
43.36	8947	.1435E-01	.5648E-03	43.08	39.26
44.50	9013	.1726E-01	.6795E-03	44.23	40.25
46.85	9137	.1864E-01	.7337E-03	45.31	41.23
48.22	9198	.2327E-01	.9161E-03	46.47	42.29

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TABLE D1-54

SPECIMEN NUMBER: U63-1L9
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
ENVIRONMENT: LAB AIR
TEST TEMPERATURE: 453.0 K
SPECIMEN THICKNESS: 1.66 MM (0.065 IN)
MAXIMUM STRESS: 195.9 MPa (28.4 KSI)
R-RATIO: .05
FREQUENCY: 200 Hz
CYCLES TO FAILURE: 1884 CYCLES
REMARKS: 1 CYCLE PRIOR TO FAILURE 79.56 MPa SQRT(M) (72.46 KSI SQRT(IN))

CHECK LENGTH MM	IN	CYCLES 1	DELTA(K)/DELTA(N)		DELTA(STRESS INTENSITY)	
			MM/CYCLE	IN/CYCLE	MPa SQRT(M)	KSI SQRT(IN)
6.73	.167	153	.4211E-02	.1658E-03	26.57	24.18
7.41	.179	143	.4377E-02	.1733E-03	28.23	25.69
8.44	.192	143	.4733E-02	.1745E-03	29.79	27.11
8.84	.192	123	.5442E-02	.2516E-03	30.76	27.99
9.53	.175	121	.5746E-02	.2273E-03	31.73	29.47
11.23	.167	795	.6195E-02	.3329E-03	32.96	30.36
11.86	.178	843	.6437E-02	.3777E-03	34.06	31.00
11.82	.177	932	.6475E-02	.3317E-03	35.10	31.94
11.82	.177	932	.1161E-01	.4211E-03	36.20	32.35
12.84	.194	934	.9182E-02	.3634E-03	37.49	34.12
13.17	.17	1147	.1243E-01	.5918E-03	38.80	35.31
14.16	.194	1154	.1392E-02	.3939E-03	39.77	36.14
14.61	.177	1233	.1421E-01	.5991E-03	40.71	37.05
15.47	.192	1766	.1143E-01	.4186E-03	41.68	37.33
15.17	.175	1317	.2301E-01	.7873E-03	42.74	38.93
17.12	.174	1372	.1583E-01	.6612E-03	44.04	40.38
17.94	.175	1421	.1146E-01	.4212E-03	45.11	41.05
18.77	.173	1451	.1783E-01	.7041E-03	46.04	41.89
19.43	.174	1436	.2314E-01	.9127E-03	47.44	43.18
21.15	.173	1667	.2503E-01	.1145E-02	49.13	44.71
22.14	.172	1826	.4138E-01	.1617E-02	50.61	45.96
23.77	.172	1815	.1256E-01	.1273E-02	51.94	47.27
F 24.64	.175	1874	.2888E-01	.1121E-02	53.31	48.52
F 25.78	.1715	1714	.4657E-01	.1833E-02	54.74	49.82
F 27.14	.17	1744	.5977E-01	.2333E-02	56.50	51.42
F 28.96	.1740	1774	.6773E-01	.2667E-02	58.57	53.30
F 31.94	.172	1844	.1014E-01	.2000E-02	60.20	54.79
F 32.20	.1750	1824	.8467E-01	.3333E-02	61.42	55.89
F 33.27	.1710	1833	.1355E-01	.5333E-02	63.15	57.47
F 35.31	.1730	1854	.1524E-01	.6003E-02	65.01	59.16
F 35.47	.1752	1864	.2543E-01	.1009E-01	66.45	60.48
F 38.10	.1700	1849	.1810E-01	.1500E-01	68.09	61.96
F 40.60	.1725	1874	.5427E-01	.2333E-01	69.98	63.68
F 41.78	.1745	1977	.5083E-01	.2600E-01	71.41	64.99
F 42.80	.1785	1873	.6350E-01	.2500E-01	72.91	66.35
F 44.70	.1760	1883	.1851E-01	.6500E-01	74.73	68.01
F 46.36	.1725	1883				

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FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974

TABLE D1-55

SPECIMEN NUMBER: U63-6T3
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: 180°
CONSTRAINT: UNSTIFFENED
ENVIRONMENT: LAB AIR
TEST TEMPERATURE: 65.0 K
SPECIMEN THICKNESS: 1.65 MM (0.065 IN)
MAXIMUM STRESS: 195.8 MPA (28.4 KSI)
R-RATIO: 0
FREQUENCY: 200 CPS
CYCLES TO FAILURE: 1218 CYCLES
K(MAX) 1 CYCLES PRIOR TO FAILURE: 78.61 MPA SQRT(M) (64.26 KSI SQRT(IN))

CRACK LENGTH MM	IN	CYCLES	DELTA (A)/DELTA (M) MM/CYCLE	IN/CYCLE	DELTA (STRESS INTENSITY) MPA SQRT(M)	KSI SQRT(IN)
6.44	.253	1	.7434E-02	.3806E-03	27.18	24.74
7.12	.280	91	.8864E-02	.3498E-03	29.90	27.21
9.28	.365	132	.9462E-02	.3725E-03	32.61	29.68
10.21	.402	432	.1088E-01	.4285E-03	34.17	31.18
11.14	.439	518	.1092E-01	.4388E-03	35.31	32.13
11.63	.458	563	.1384E-01	.5132E-03	36.42	33.14
12.57	.495	635	.1414E-01	.5567E-03	38.15	34.72
13.94	.549	732	.1121E-01	.4415E-03	39.52	35.96
14.47	.570	779	.2361E-01	.9297E-03	40.42	36.79
15.23	.599	811	.2881E-01	.8192E-03	41.69	37.94
16.31	.642	863	.1672E-01	.6581E-03	42.83	38.90
16.93	.666	988	.2588E-01	.1816E-02	43.78	39.84
17.75	.699	932	.1631E-01	.7218E-03	44.68	40.66
18.32	.721	963	.3246E-01	.1278E-02	45.56	41.46
19.13	.753	988	.4438E-01	.1747E-02	47.01	42.78
20.64	.813	1822	.2893E-01	.1139E-02	48.74	44.36
F 21.97	.865	1868	.5080E-01	.2000E-02	50.73	46.17
F 24.00	.945	1108	.6531E-01	.2571E-02	53.22	48.43
F 26.29	1.035	1143	.9652E-01	.3808E-02	55.85	50.82
F 28.70	1.130	1168	.8259E-01	.3250E-02	58.07	52.84
F 30.35	1.195	1188	.1651E+00	.6588E-02	59.84	54.46
F 32.00	1.260	1198	.1143E+00	.4588E-02	61.32	55.81
F 33.15	1.305	1208	.5888E+00	.2000E-01	63.26	57.57
F 35.69	1.405	1213	.6832E+00	.2375E-01	65.84	59.91
F 38.10	1.500	1217				

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TABLE D1-56

SPECIMEN NUMBERS			UNITS-STD			
SPECIMEN ORIENTATION			TEST TEMPERATURE			
CONSTRAINTS			ENVIRONMENT			
TEST TEMPERATURE			SPECIMEN THICKNESS			
SPECIMEN THICKNESS			MAXIMUM STRESS			
FREQUENCY			CYCLES TO FAILURE			
CYCLES TO FAILURE			K(MAX) 441 CYCLES PRIOR TO FAILURE			
			46.41 MPA SORT(M) (42.24 KSI SORT(M))			
CRACK LENGTH	MM	CYCLES	DELTA(A)/DELTA(I)	DELTA(Stress)	INTENSITY	
			MM/CYCLE	MPA SORT(M)	KSI SORT(M)	
8.70	.342	1	.1976E-02	.7780E-04	18.97	17.26
9.26	.365	287	.1714E-02	.6749E-04	19.67	17.98
10.02	.394	730	.1796E-02	.7070E-04	20.44	18.60
10.79	.425	1168	.2540E-02	.1088E-03	21.19	19.25
11.48	.452	1429	.2055E-02	.8089E-04	21.66	19.72
11.87	.467	1620	.3494E-02	.1376E-03	22.15	20.16
12.51	.493	1805	.2458E-02	.9679E-04	22.69	20.65
13.05	.514	2023	.2885E-02	.1136E-03	23.26	21.15
13.74	.541	2262	.3690E-02	.1493E-03	23.90	21.75
14.56	.573	2484	.3226E-02	.1270E-03	24.62	22.40
15.44	.608	2756	.3947E-02	.1894E-03	25.30	23.03
16.20	.638	2953	.2669E-02	.1051E-03	25.77	23.45
16.57	.652	3088	.4482E-02	.1765E-03	26.19	23.83
17.26	.679	3241	.6238E-02	.1668E-03	27.08	24.64
18.03	.741	3612	.6256E-02	.2463E-03	28.13	25.48
20.01	.788	3801	.6399E-02	.2519E-03	29.07	26.45
21.34	.840	4008	.6052E-02	.2303E-03	30.10	27.39
22.83	.899	4255	.8243E-02	.3245E-03	31.09	28.29
24.12	.950	4412	.8103E-02	.3192E-03	31.54	29.09
25.35	.998	4563	.7628E-02	.3003E-03	32.81	29.86
26.59	1.047	4726	.8100E-02	.3189E-03	34.13	31.06
29.27	1.153	5057	.1090E-01	.4292E-03	35.46	32.27
30.86	1.206	5182	.1122E-01	.4417E-03	36.35	33.08
31.99	1.260	5303	.1232E-01	.4849E-03	37.25	33.90
33.46	1.317	5422	.1273E-01	.5014E-03	38.16	34.73
34.85	1.372	5531	.1205E-01	.4746E-03	39.03	35.52
36.20	1.425	5643	.1616E-01	.6361E-03	39.94	36.35
37.76	1.487	5740	.1581E-01	.6224E-03	40.91	37.23
39.28	1.547	5836	.1752E-01	.6896E-03	41.83	38.07
40.72	1.603	5918	.1748E-01	.6883E-03	42.78	38.94
42.36	1.666	6012	.2743E-01	.1080E-02	43.69	39.76
43.65	1.719	6059				

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2024-T861 AND 2124-T851

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TABLE D1-57

SPECIMEN NUMBER: 63-118
ALLOY TYPE: 2024-T861
SPECTHEN ORIENTATION: LONGITUDINAL
CONSTRAINTS: STIFFENED
ENVIRONMENT: LAB AIR
TEST TEMPERATURE: 678.0 K
SPECIMEN THICKNESS: 1.63 MM (1.032 IN)
MAXIMUM STRESS: 117.2 MPA (17.8 KSI)
FREQUENCY: 280 CPM
CYCLES TO FAILURE: 25537 CYCLES
K(MAX): 26 CYCLES PRIOR TO FAILURE: 83.21 MPA SQRT(M) (75.72 KSI SQRT(IN))

CRACK LENGTH MM	CRACK LENGTH IN	CYCLES	DELTA(K)/DELTA(IN) MM/CYCLE	DELTA(K)/DELTA(IN) IN/CYCLE	DELTA(1/STRESS INTENSITY) MPA SQRT(M)	DELTA(1/STRESS INTENSITY) KSI SQRT(IN)
3.34	.131	1	.1615E-03	.6359E-03	11.97	10.89
4.01	.158	4145	.2591E-03	.1020E-04	13.00	11.83
4.66	.191	6655	.3094E-03	.1214E-04	13.92	12.67
5.28	.208	8646	.4273E-03	.1642E-04	14.75	13.42
5.87	.231	10043	.4543E-03	.1791E-04	15.57	14.17
6.44	.254	11523	.5034E-03	.2240E-04	16.33	14.86
7.12	.280	12499	.7922E-03	.3110E-04	17.50	16.30
8.70	.342	14497	.8955E-03	.3526E-04	18.70	17.09
9.23	.367	15199	.1326E-02	.5220E-04	19.44	17.70
9.99	.393	15694	.1383E-02	.5446E-04	20.10	18.29
11.64	.449	16169	.1294E-02	.5095E-04	20.72	18.85
11.79	.443	16442	.1656E-02	.6514E-04	21.33	19.41
11.94	.470	17057	.1743E-02	.7019E-04	21.90	19.93
12.50	.492	17369	.1993E-02	.7846E-04	22.45	20.43
13.16	.513	17731	.1986E-02	.7821E-04	23.07	21.00
13.42	.547	18075	.2105E-02	.8204E-04	23.66	21.53
14.02	.572	18373	.2345E-02	.9388E-04	24.21	22.03
15.23	.599	18455	.2734E-02	.1076E-03	24.77	22.54
15.88	.625	18935	.2825E-02	.1112E-03	25.37	23.09
16.69	.657	19186	.2642E-02	.1096E-03	25.95	23.62
17.35	.683	19436	.3131E-02	.1233E-03	26.44	24.06
17.94	.706	19625	.3426E-02	.1349E-03	26.92	24.50
18.60	.732	19817	.2971E-02	.1170E-03	27.72	25.23
20.14	.789	20333				
21.34	.842	21688	.3487E-02	.1373E-03	28.75	26.16
22.80	.894	21049	.3912E-02	.1540E-03	29.74	27.06
24.12	.946	21313	.4544E-02	.1789E-03	30.66	27.91
25.44	1.000	21625	.4493E-02	.1771E-03	31.56	28.72
26.44	1.047	21893	.4367E-02	.1717E-03	32.43	29.51
27.94	1.100	22154	.4995E-02	.1967E-03	33.26	30.26
29.12	1.147	22394	.5243E-02	.2064E-03	34.11	31.04
30.47	1.200	22613	.6170E-02	.2429E-03	34.93	31.79
31.81	1.252	22829	.6162E-02	.2426E-03	35.79	32.58
33.24	1.304	23026	.7274E-02	.2865E-03	36.67	33.38
34.63	1.362	23203	.7431E-02	.2926E-03	37.55	34.18
36.44	1.411	23379	.7521E-02	.2961E-03	38.37	34.92
37.76	1.467	23547	.8196E-02	.3227E-03	39.20	35.67
38.47	1.515	23691	.8431E-02	.3319E-03	40.01	36.41
39.63	1.563	23823	.8845E-02	.3478E-03	40.76	37.09
40.54	1.575	23937	.7442E-01	.1040E-02	42.01	38.23
44.20	1.740	24137	.8255E-02	.3250E-03	43.39	39.49
46.61	1.835	24337	.1236E-01	.4793E-03	44.64	40.62
49.24	1.940	24537	.1333E-01	.5250E-03	46.20	42.04
50.46	2.004	24717	.1841E-01	.7250E-03	48.16	43.83
59.45	2.335	24937	.3043E-01	.1200E-02	51.25	46.64
60.41	2.375	25107	.1540E-01	.6222E-03	54.38	49.49
65.02	2.550	25237	.3217E-01	.1267E-02	56.38	51.31
66.47	2.625	25247	.3703E-01	.1300E-02	57.77	52.57
69.94	2.735	25317	.6634E-01	.2630E-02	59.51	54.16
72.02	2.875	25387	.6094E-01	.2470E-02	61.41	56.25
80.14	3.130	25427	.2054E-01	.8875E-02	66.45	63.47
84.71	3.335	25457	.8494E-01	.3530E-02	71.36	64.94
86.43	3.375	25457	.9144E-01	.3603E-02	73.59	66.97
88.17	3.510	25512	.1340E-00	.4250E-02	75.69	68.88
91.46	3.570	25517	.1524E-00	.6030E-02	77.84	72.87

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TABLE D1-58

SPECIMEN NUMBER: 69-013						
ALLOY TYPE: 2024-T861						
SPL. IMEN ORIENTATION: LONGITUDINAL						
CONSTRAINT: STRESS						
ENVIRONMENT: LAB AIR						
TEST TEMPERATURE: 70 ± 1 °F						
SPL. IMEN THICKNESS: 1.64 MM (0.064 IN)						
MAXIMUM STRESS: 194.8 MPA (28.4 KSI)						
FREQUENCY: 200 CYCLES						
CYCLES TO FAILURE: 2024 CYCLES						
(NET STRESS GREATER THAN 0.9 FTY)						
CRACK LENGTH MM	IN	CYCLES	DELTA(K)/DELTA(N) MM/CYCLE	IN/CYCLE	DELTA(K) STRESS MPA SORTING	INTENSITY KSI SORTING
2.91	.114	1	.0270E-03	.3653E-04	18.01	10.96
3.16	.124	935	.2453E-02	.9681E-04	10.46	18.62
4.28	.167	910	.1496E-02	.6283E-04	22.00	20.02
4.66	.183	1175	.2013E-02	.1167E-03	23.35	21.74
4.36	.171	1417	.4033E-02	.1933E-03	25.06	22.41
6.17	.243	1507	.4132E-02	.1627E-03	21.54	24.19
6.79	.267	1737	.5714E-02	.2053E-03	27.00	25.30
7.19	.283	1845	.7297E-02	.2774E-03	29.23	26.42
8.07	.318	1343	.7231E-02	.2835E-03	30.14	27.62
8.81	.347	2046	.9471E-02	.3779E-03	31.60	28.76
9.44	.373	2116	.1766E-02	.1865E-03	33.26	31.27
10.77	.424	2744	.1457E-03	.6110E-03	34.84	31.75
11.44	.452	2234	.1673E-01	.6192E-03	36.04	32.85
12.37	.494	2346	.1677E-01	.6981E-03	37.40	34.03
13.20	.520	2402	.1345E-01	.5452E-03	38.44	35.23
13.78	.543	2447	.2430E-01	.1600E-03	39.52	35.97
14.44	.576	2477	.2340E-01	.9250E-03	40.52	36.88
15.10	.599	2621	.2165E-01	.4520E-03	41.21	37.50
15.81	.625	2421	.1271E-01	.1280E-02	42.08	38.30
16.49	.649	2467	.2431E-01	.9477E-03	43.87	39.20
17.17	.674	2473	.2443E-01	.1571E-02	44.93	39.98
17.42	.683	2540	.4422E-01	.1741E-02	45.00	40.95
18.77	.734	2612	.4472E-01	.1760E-02	46.18	42.02
19.46	.774	2637				
21.42	.847	2677	.4123E-01	.1823E-02	47.87	43.57
22.36	.881	2693	.4981E-01	.2343E-02	49.49	45.36
23.06	.903	2713	.6724E-01	.2294E-02	50.93	46.36
24.46	.962	2743	.6823E-01	.2686E-02	52.72	47.97
26.44	1.041	2757	.8167E-01	.2624E-02	54.12	49.76
28.42	1.112	2775	.9758E-01	.3842E-02	55.65	50.65
29.32	1.154	2786	.1024E+00	.3055E-02	57.22	52.07
30.32	1.194	2786	.1144E+00	.4443E-02	58.69	53.45
32.37	1.270	2803	.1762E+00	.7014E-02	60.23	54.81
33.74	1.328	2815	.1746E+00	.6867E-02	61.72	56.17
35.13	1.381	2824	.1737E+00	.6837E-02	63.27	57.44
36.13	1.413	2824	.1734E+00	.5273E-02	64.13	60.14
F	38.24	2855	.2286E+00	.9000E-02	69.43	63.18
F	41.53	2865	.2746E+00	.9000E-02	71.77	65.31
F	43.01	2875	.2702E+00	.1150E-01	74.44	67.74
F	46.74	2885	.3467E+00	.1347E-01	77.18	70.23
F	49.15	2892	.4733E+00	.1867E-01	79.74	72.57
F	51.69	2898	.4445E+00	.1790E-01	81.49	74.61
F	53.47	2907	.6153E+00	.2400E-01	84.26	76.88
F	56.01	2906	.4847E+00	.1833E-01	86.36	78.44
F	57.40	2909	.8243E+00	.3167E-01	88.42	80.46
F	59.82	2917	.8467E+00	.3333E-01	91.13	82.93
F	62.36	2914	.9443E+00	.3875E-01	94.77	86.24
F	66.29	2914				
F	67.82	2920				
F	69.47	2921				
F	72.14	2922				
F	75.31	2923				
F	81.25	2924				

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TABLE D1-59

SPECIMEN NUMBER1 ALLOY TYPE1 SPECIMEN ORIENTATION1 CONSTRAINT1 ENVIRONMENT1 TEST TEMPERATURE1 SPECIMEN THICKNESS1 MAXIMUM STRESS1 FREQUENCY1 CYCLES TO FAILURE1 K(MAX) 971 CYCLES PRIOR TO FAILURE1				60-576 2024-T861 TRANSVERSE STIFFNESS 1.66 MM (1.665 IN) 117.2 MPA (17.0 KSI) 200 CPM 20298 CYCLES 43.87 MPA SQRT(IN) (39.92 KSI SQRT(IN))			
CRACK LENGTH MM IN	TH IN	CYCLES	DELTA(A)/DELTA(N) MM/CYCLE IN/CYCLE	DELTA(Stress Intensity) MPA SQRT(IN) KSI SQRT(IN)	DELTA(Stress Intensity) MPA SQRT(IN) KSI SQRT(IN)	DELTA(Stress Intensity) MPA SQRT(IN) KSI SQRT(IN)	DELTA(Stress Intensity) MPA SQRT(IN) KSI SQRT(IN)
3.37	.133	1	.1809E-03	.7121E-05	11.90	10.83	
3.90	.153	2929	.2778E-03	.1894E-04	12.87	11.71	
4.60	.181	5462	.4537E-03	.1786E-04	13.91	12.66	
5.33	.210	7063	.4898E-03	.1928E-04	14.82	13.49	
5.93	.234	8305	.5798E-03	.2283E-04	15.61	14.21	
6.55	.258	9374	.7371E-03	.2902E-04	16.51	15.02	
7.40	.291	10518	.9589E-03	.3775E-04	17.41	15.84	
8.11	.319	11257	.1024E-02	.4030E-04	18.22	16.58	
8.87	.349	11999	.1000E-02	.3938E-04	19.21	17.46	
9.99	.393	13120	.2174E-02	.8559E-04	20.10	18.29	
10.63	.418	13415	.2001E-02	.7880E-04	20.75	18.88	
11.33	.446	13764	.1977E-02	.7782E-04	21.41	19.40	
12.03	.474	14118	.1666E-02	.6559E-04	21.99	20.01	
12.59	.496	14458	.1849E-02	.9479E-04	22.58	20.55	
13.33	.525	14765	.2429E-02	.9561E-04	23.24	21.15	
14.11	.555	15084	.3047E-02	.1.00E-03	23.90	21.75	
14.88	.586	15337	.3318E-02	.1306E-03	24.52	22.32	
15.59	.614	15553	.3667E-02	.1207E-03	25.04	22.78	
16.13	.635	15729	.3619E-02	.1425E-03	25.53	23.24	
16.83	.663	15922	.3372E-02	.1328E-03	26.12	23.77	
17.61	.694	16154	.4198E-02	.1653E-03	26.79	24.38	
18.56	.731	16380	.4323E-02	.1702E-03	27.42	24.96	
19.28	.759	16546	.4649E-02	.1830E-03	28.23	25.69	
20.73	.816	16858	.4884E-02	.1923E-03	29.23	26.60	
22.03	.867	17124	.5378E-02	.2117E-03	30.26	27.54	
23.63	.930	17422	.5581E-02	.2197E-03	31.26	28.46	
24.91	.981	17650	.6680E-02	.2630E-03	32.21	29.31	
26.42	1.040	17877	.6696E-02	.2636E-03	33.26	30.27	
28.04	1.104	18119	.7821E-02	.3079E-03	34.26	31.18	
29.47	1.160	18302	.8602E-02	.3387E-03	35.21	32.04	
30.95	1.219	18474	.8836E-02	.3479E-03	36.28	33.01	
32.82	1.292	18685	.1189E-01	.4660E-03	37.32	33.97	
34.27	1.349	18807	.1081E-01	.4255E-03	38.30	34.86	
35.94	1.415	18962	.1158E-01	.4559E-03	39.28	35.75	
37.41	1.473	19089	.1236E-01	.4867E-03	40.23	36.61	
39.00	1.535	19217	.1430E-01	.5632E-03	41.20	37.49	
40.57	1.597	19327					

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TABLE D1-60

SPECIMEN NUMBER: 63-4112
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINTS: STIFFNESS
TEST ENVIRONMENT: LLV
SPECIMEN THICKNESS: 1.65 MM (.065 IN)
MAXIMUM STRESS: 199.8 MPA (28.6 KSI)
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 2390 CYCLES
K(MAX): 200 CYCLES PRIOR TO FAILURE: 50.26 MPA SORT(M) (49.74 KSI SORT(M))

CRACK LENGTH MM	IN	CYCLES	DELTA(A)/DELTA(N) MM/CYCLE	IN/CYCLE	DELTA STRESS MPA SORT(M)	INTENSITY KSI SORT(M)
3.64	.144	1	.3244E-02	.1277E-03	20.56	18.71
4.12	.162	149	.1943E-02	.7691E-04	21.80	19.84
4.61	.181	398	.3892E-02	.1532E-03	23.11	21.03
5.21	.205	552	.4023E-02	.1584E-03	24.51	22.31
5.83	.230	707	.4460E-02	.1756E-03	26.56	24.17
7.12	.280	996	.6595E-02	.2581E-03	28.45	25.89
7.73	.304	1089	.5867E-02	.2310E-03	29.81	27.13
8.56	.337	1231	.7648E-02	.3011E-03	31.20	28.39
9.27	.365	1323	.8662E-02	.3410E-03	32.47	29.55
10.04	.395	1412	.7890E-02	.3106E-03	33.74	30.78
10.78	.424	1506	.8584E-02	.3380E-03	34.91	31.77
11.49	.452	1589	.9680E-02	.3811E-03	36.09	32.84
12.29	.484	1671	.1203E-01	.4738E-03	37.27	33.91
13.04	.514	1734	.9336E-02	.3875E-03	38.22	34.78
13.58	.535	1791	.1584E-01	.6196E-03	39.15	35.63
14.33	.564	1839	.1816E-01	.7149E-03	40.29	36.66
15.18	.598	1886	.1712E-01	.6742E-03	41.25	37.54
15.71	.619	1917	.1870E-01	.7361E-03	42.06	38.28
16.38	.645	1953	.2291E-01	.9819E-03	42.93	39.07
17.00	.669	1980	.2193E-01	.8633E-03	43.77	39.83
17.66	.695	2010	.2821E-01	.1111E-02	44.70	40.68
18.45	.726	2038	.2212E-01	.8718E-03	45.64	41.56
19.14	.753	2069	.3296E-01	.1298E-02	46.92	42.70
20.49	.807	2110				

TABLE D1-61

SPECIMEN NUMBER: 0-3-11F
ALLOY TYPE: 2124-T851
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINTS: UNSTIFFNESS
TEST ENVIRONMENT: LLV
SPECIMEN THICKNESS: 1.61 MM (.063 IN)
MAXIMUM STRESS: 117.6 MPA (17.0 KSI)
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 4569 CYCLES
K(MAX): 1 CYCLE PRIOR TO FAILURE: 44.83 MPA SORT(M) (43.93 KSI SORT(M))

CRACK LENGTH MM	IN	CYCLES	DELTA(A)/DELTA(N) MM/CYCLE	IN/CYCLE	DELTA STRESS MPA SORT(M)	INTENSITY KSI SORT(M)
4.64	.181	1	.4311E-03	.3666E-04	19.37	17.35
5.13	.201	1449	.1571E-02	.6104E-04	19.48	18.15
5.61	.221	1957	.1551E-02	.6173E-04	20.77	19.40
6.10	.240	2185	.2877E-02	.1154E-03	21.47	19.49
6.69	.263	2470	.1374E-02	.1212E-03	22.26	20.07
7.18	.283	2651	.1565E-02	.8550E-04	22.60	20.56
7.74	.305	2844	.2912E-02	.9891E-04	22.95	21.02
8.34	.328	3015	.1714E-02	.6754E-04	23.37	21.22
8.92	.350	3173	.2354E-02	.9284E-04	23.74	21.61
9.50	.374	3561	.1931E-02	.7673E-04	24.74	22.36
10.03	.395	3778	.2781E-02	.1135E-03	24.71	22.49
10.64	.417	3913	.4444E-02	.1749E-03	25.23	22.96
11.27	.440	4033	.2307E-02	.9881E-04	25.66	23.35
11.95	.467	4138	.3455E-02	.1384E-03	25.72	23.68
12.66	.498	4375	.4441E-02	.1748E-03	26.46	24.08
13.41	.528	4619	.2104E-02	.8293E-04	26.84	24.42
14.19	.559	4850	.5206E-02	.2050E-03	27.22	24.77
15.01	.591	5045	.3115E-02	.1224E-03	27.69	25.19
15.87	.625	5271	.5302E-02	.1964E-03	28.28	25.74
16.79	.660	5371	.5364E-02	.1994E-03	29.25	26.62
17.75	.696	5602	.4327E-02	.1703E-03	30.22	27.50
18.78	.736	5877	.5551E-02	.2185E-03	31.11	28.31
19.86	.778	6041	.6412E-02	.2524E-03	32.01	29.13

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26.84	1.053	6241	.6652E-02	.2619E-03	32.83	29.88
27.42	1.095	6374	.7415E-02	.2919E-03	33.67	30.64
29.56	1.164	66.5	.8322E-02	.3276E-03	34.63	31.51
30.54	1.202	6714	.9078E-02	.3574E-03	35.52	32.32
33.41	1.315	7025	.9261E-02	.3628E-03	36.77	33.46
35.32	1.391	7294	.7038E-02	.2775E-03	38.29	34.85
36.54	1.442	7441	.9213E-02	.3676E-03	39.31	35.78
38.44	1.517	7611	.1123E-01	.4422E-03	40.29	36.67
39.64	1.562	7893	.1278E-01	.4531E-03	41.24	37.53
41.71	1.642	7853	.1277E-01	.5106E-03	42.26	38.46
43.07	1.696	7931	.1745E-01	.7026E-03	43.31	39.41
45.47	1.790	8065	.1778E-01	.7000E-03	44.47	40.47
46.74	1.843	8134	.1879E-01	.7397E-03	45.62	41.51
48.84	1.923	8204	.2825E-01	.1112E-02	46.66	42.47
50.26	1.973	8253	.3164E-01	.1248E-02	47.76	43.47
F 51.69	2.035	8235	.3191E-01	.1338E-02	48.66	44.28
F 54.23	2.135	8345	.5083E-01	.2002E-02	49.92	45.43
F 56.39	2.220	8345	.5197E-01	.2175E-02	51.42	46.73
F 58.67	2.310	8415	.7624E-01	.3038E-02	52.86	48.10
F 61.47	2.420	8445	.9313E-01	.3667E-02	54.53	49.63
F 62.75	2.510	8470	.9144E-01	.3608E-02	56.24	51.18
F 65.15	2.565	8445	.9313E-01	.3667E-02	57.51	52.33
F 69.80	2.740	8501	.2963E+00	.1167E-01	59.55	54.19
F 74.23	2.920	8515	.3133E+00	.1233E-01	62.89	57.23
F 76.46	3.030	8525	.2667E+00	.1050E-01	65.73	59.31
F 79.63	3.135	8531	.5334E+00	.2100E-01	67.87	61.77
F 82.56	3.250	8534	.7322E+00	.2875E-01	70.22	64.93
F 84.45	3.305	8537	.6353E+00	.2500E-01	72.34	66.83
F 86.74	3.415	8541	.7623E+00	.3001E-01	74.25	67.57
F 89.50	3.760	8543	.2921E+01	.1150E+00	79.67	72.50

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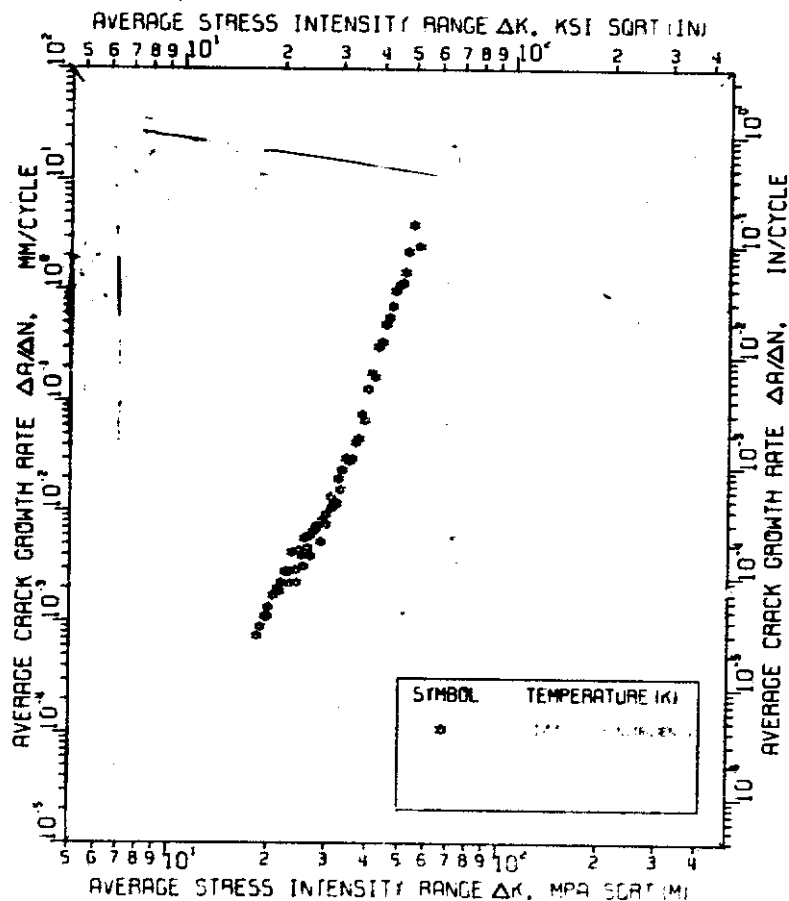
FRACTURE MECHANICS DATA FOR
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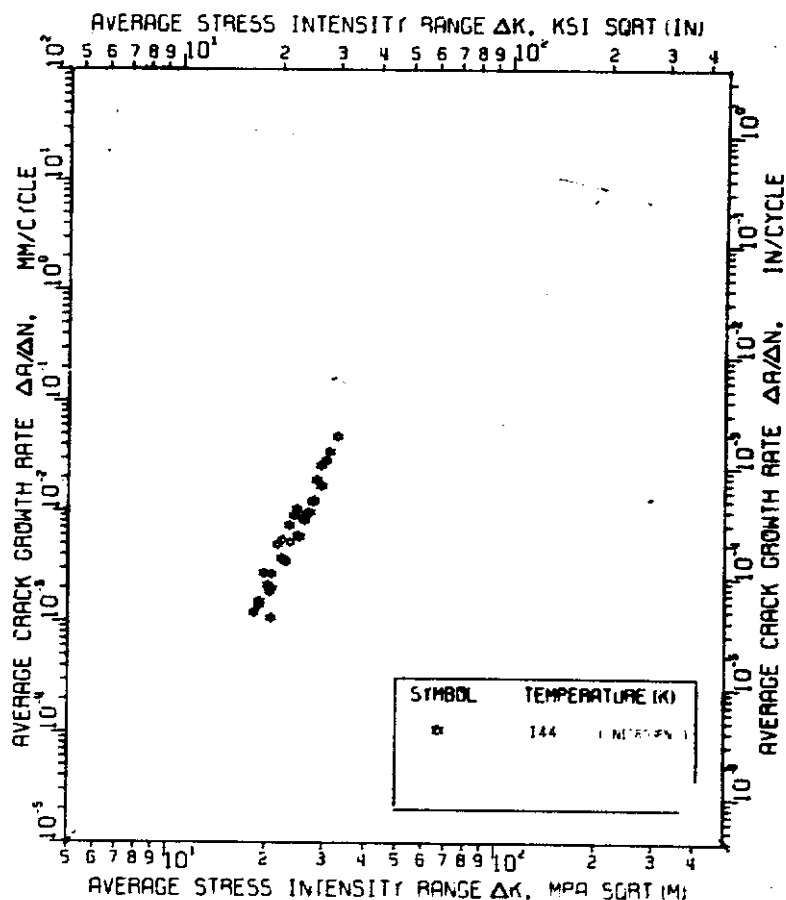
TABLE D1-62

SPECIMEN NUMBER: 063-478				2024-T861	
SPECIMEN ORIENTATION: TRANSVERSE				UNSTIFFENED	
CONSTRAINT: LAB AIR				478.0 K	
TEST TEMPERATURE: 1.66 MM (.0655 IN)				118.6 MPA (17.2 KSI)	
SPECIMEN THICKNESS: 200 CPM				7267 CYCLES	
MAXIMUM STRESS: 57.11 MPA SORT (MI) 51.97 KSI SORT (IN)				60 CYCLES PRIOR TO FAILURE	
FREQUENCY: 200 CPM				60 CYCLES PRIOR TO FAILURE	
CYCLES TO FAILURE: 57.11 MPA SORT (MI) 51.97 KSI SORT (IN)				60 CYCLES PRIOR TO FAILURE	
CRACK LENGTH	IN	CYCLES	DELTA(A)/DELTA(IN)	DELTA(Stress Intensity)	
MM		I	MM/CYCLE	MPA SORT (IN)	KSI SORT (IN)
7.47	.294		.2530E-02	.9961E-04	18.71
10.03	.395	1016	.1459E-02	.5743E-04	20.43
10.79	.425	1634	.1889E-02	.7436E-04	21.20
11.60	.457	1965	.2161E-02	.8507E-04	21.96
12.41	.489	2340	.2618E-02	.1031E-03	22.80
13.43	.529	2729	.3117E-02	.1227E-03	23.73
14.52	.572	3079	.2677E-02	.1055E-03	24.62
15.52	.611	3453	.3701E-02	.1457E-03	25.36
16.30	.642	3863	.3352E-02	.1320E-03	26.01
17.13	.674	3910	.4431E-02	.1745E-03	26.67
17.95	.707	4096	.6248E-02	.2480E-03	27.35
18.88	.743	4245	.3846E-02	.1514E-03	28.02
19.70	.776	4458	.5637E-02	.2219E-03	29.15
21.91	.863	4850	.6042E-02	.2379E-03	30.39
23.13	.911	5052	.5901E-02	.2323E-03	31.47
24.99	.984	5366	.9692E-02	.3812E-03	32.53
26.20	1.031	5491	.8394E-02	.3305E-03	33.60
28.15	1.108	5724	.1029E-01	.4050E-03	34.69
29.48	1.161	5853	.1046E-01	.4116E-03	35.82
31.59	1.244	6055	.1119E-01	.4404E-03	36.97
33.05	1.331	6185	.1319E-01	.5189E-03	38.10
35.14	1.384	6344	.1451E-01	.5714E-03	39.20
36.54	1.438	6440	.1562E-01	.6150E-03	40.26
38.52	1.516	6567	.2256E-01	.8884E-03	41.39
40.17	1.581	6640	.1615E-01	.6360E-03	42.44
41.89	1.649	6747	.2502E-01	.9852E-03	43.32
43.00	1.693	6791	.2868E-01	.1129E-02	44.74
F 46.61	1.835	6917	.3302E-01	.1300E-02	46.42
F 48.26	1.908	6967	.2286E-01	.9000E-03	47.29
F 49.40	1.945	7017	.6604E-01	.2600E-02	48.68
F 50.70	2.075	7067	.3302E-01	.1300E-02	50.25
F 54.36	2.140	7117	.3556E-01	.1400E-02	51.35
F 56.13	2.210	7167	.8890E-01	.3500E-02	53.08
F 59.69	2.350	7267			

(a) Longitudinal



(b) Transverse



Alloy: 2024-T861

Stress Ratio: .05

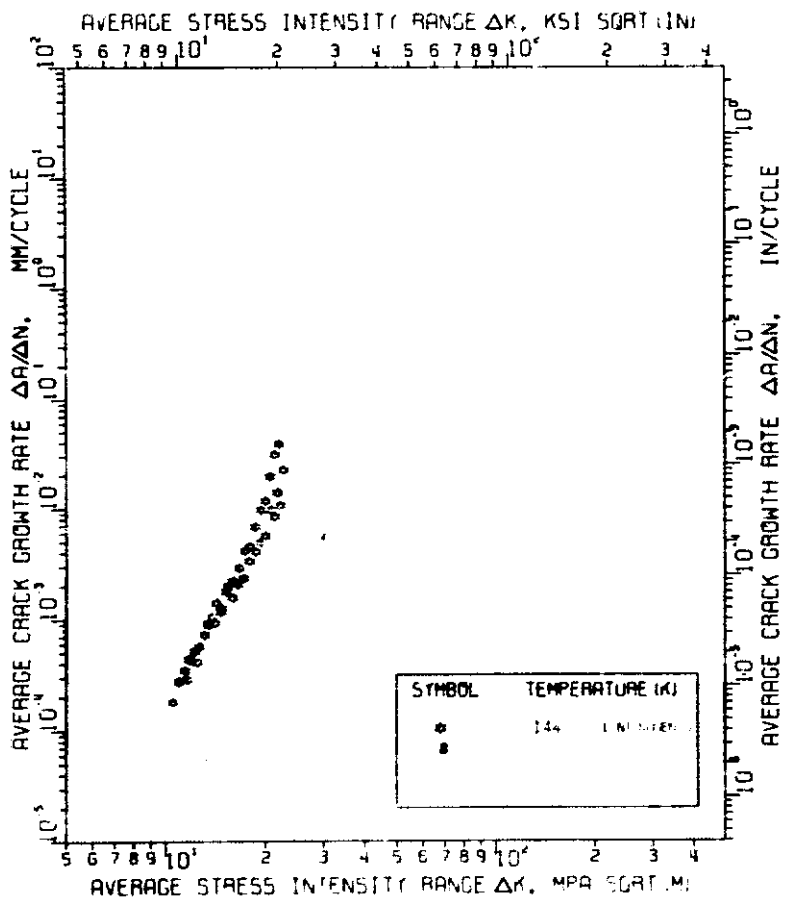
Frequency: 200 cpm

Thickness: 1.60 mm (.063 inch)

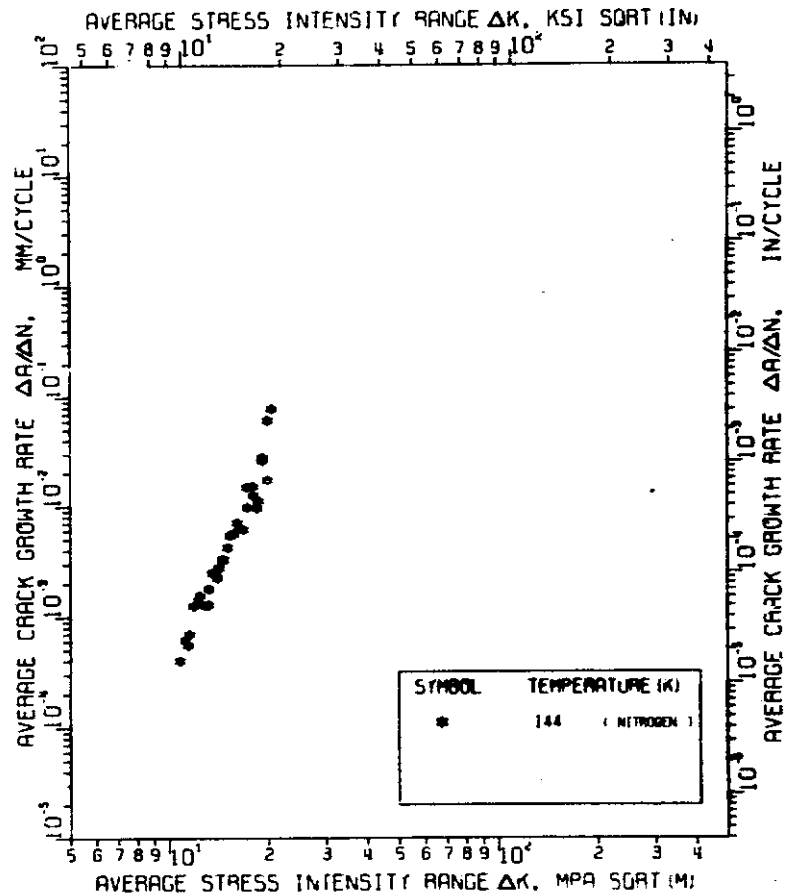
Constraint: Stiffened

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

(a) Longitudinal



(b) Transverse



Alloy: 2024-T861

Stress Ratio: .50

Frequency: 200 cpm

Thickness: 1.60 mm (.063 inch)

Constraint: Stiffened

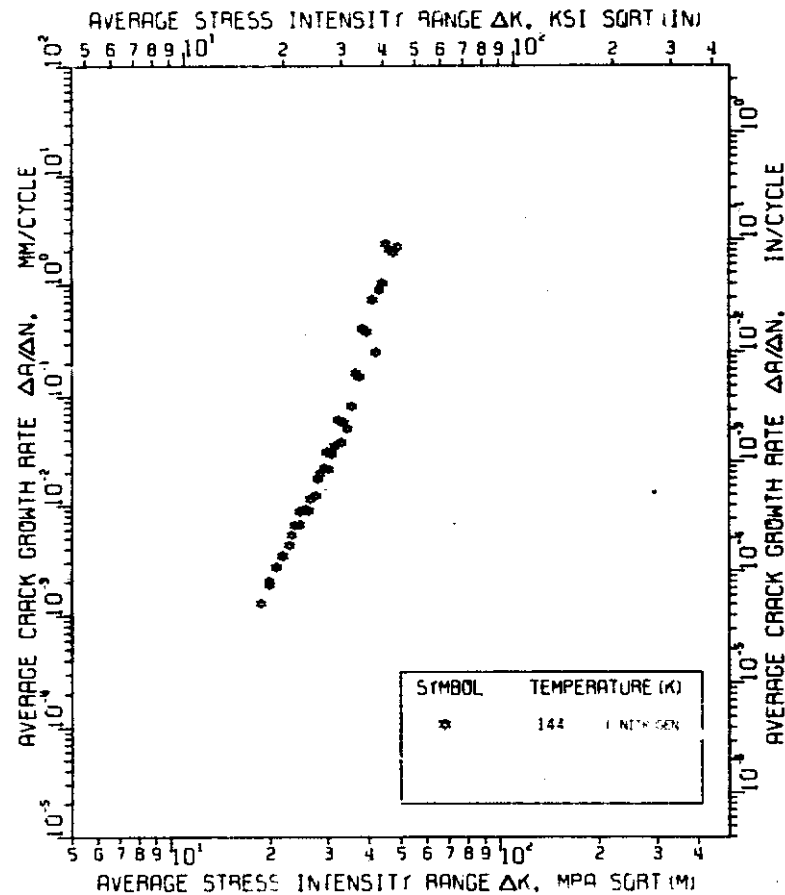
AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

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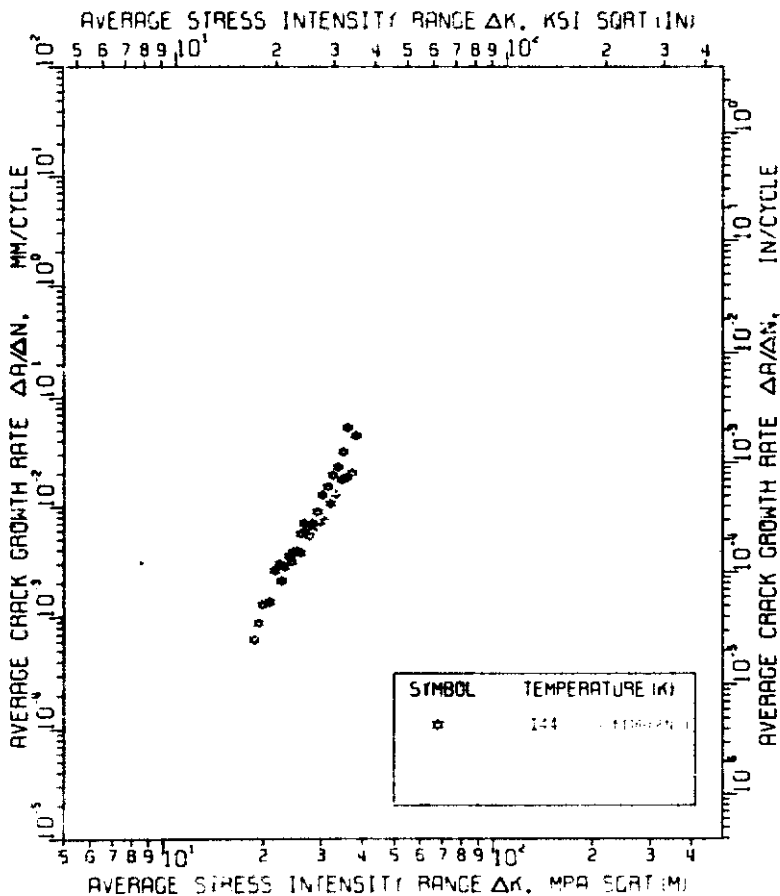
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(b) Transverse



(a) Longitudinal



Alloy: 2024-T861

Stress Ratio: .05

Frequency: 200 cpm

Thickness: 1.60 mm (.063 inch)

Constraint: Unstiffened

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

FIGURE D1-3

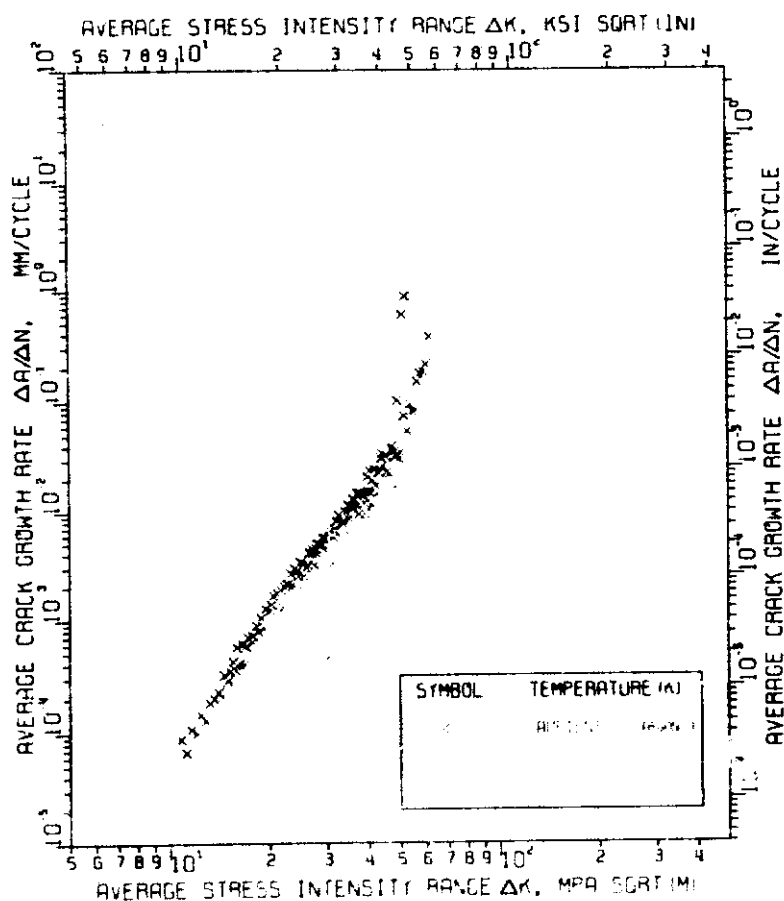
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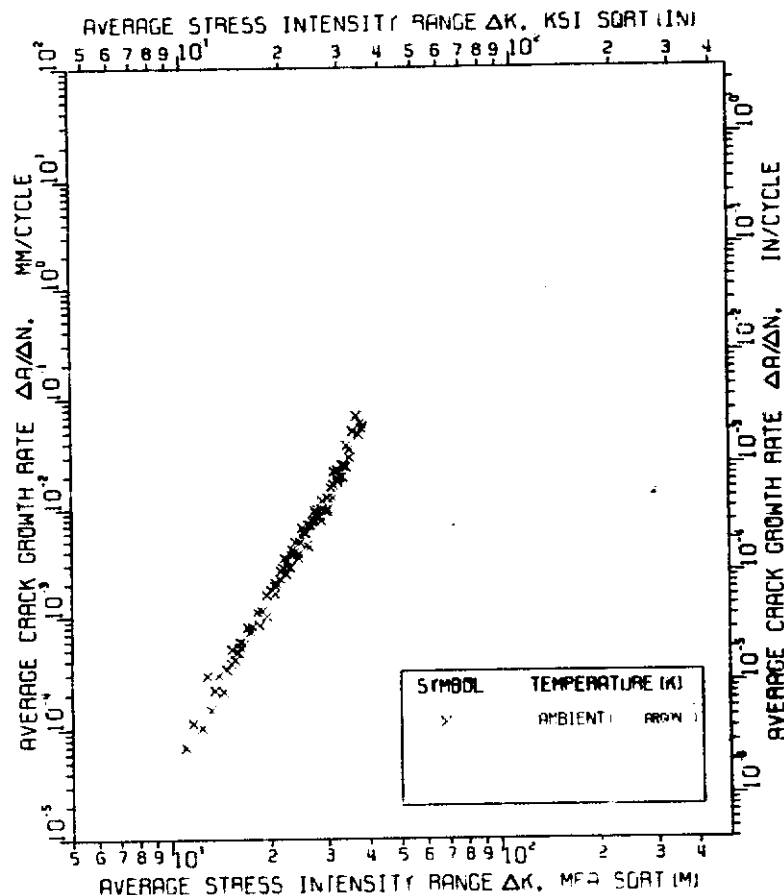
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(a) Longitudinal



(b) Transverse



Alloy: 2024-T861

Stress Ratio: .05

Frequency: 200 cpm

Thickness: 1.60 mm (.063 inch)

Constraint: Stiffened

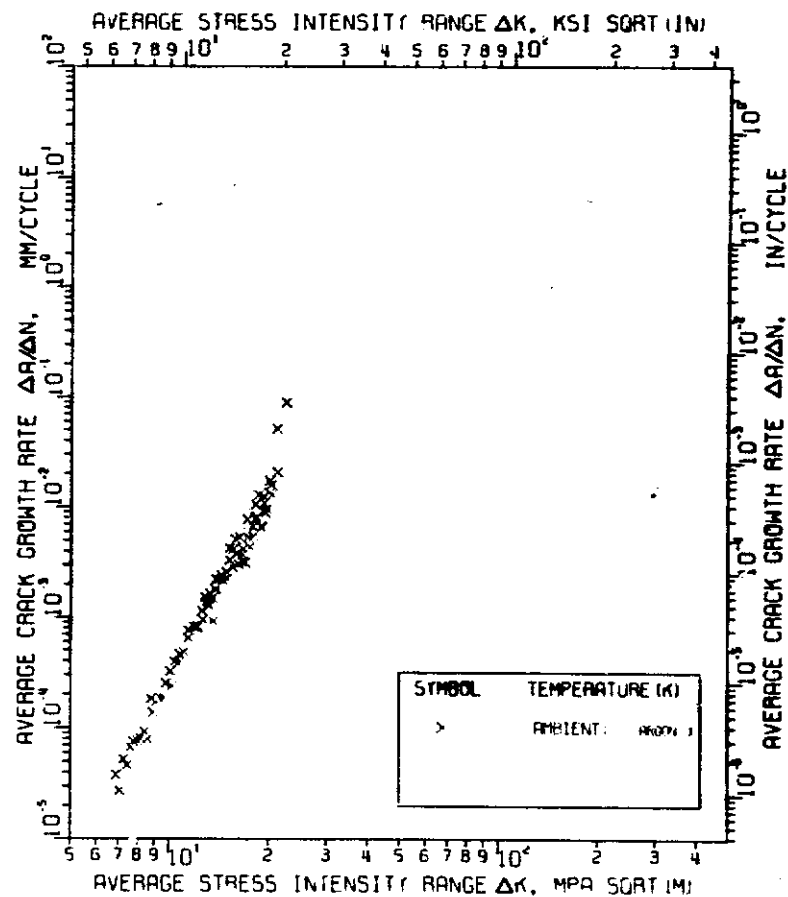
AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

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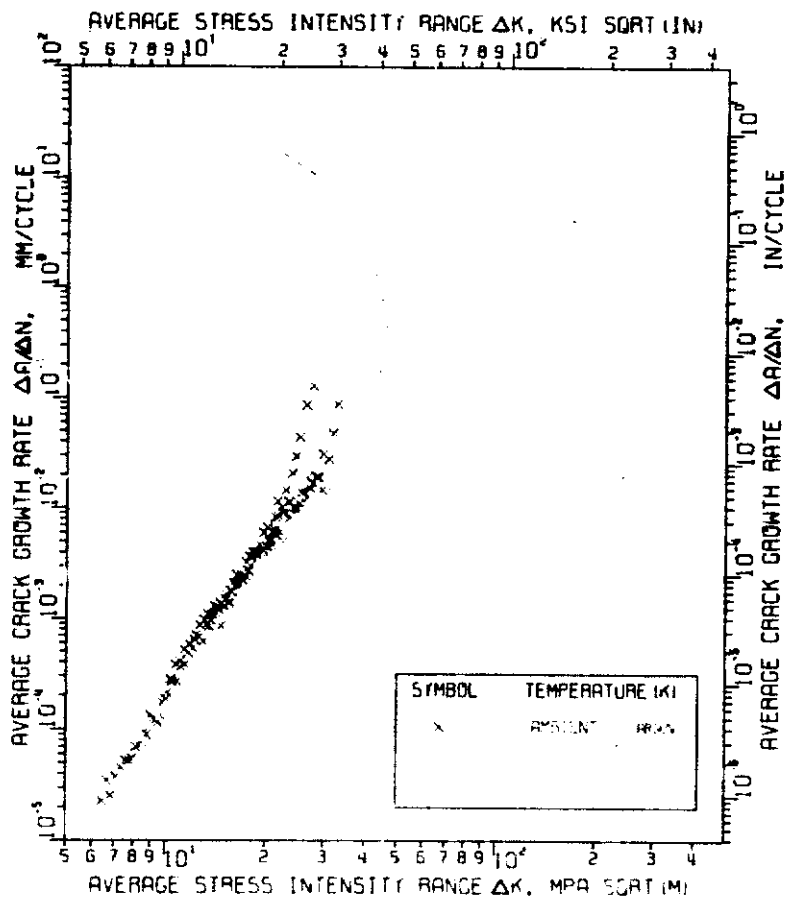
FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T861

MDC E1153
October 1974

(b) Transverse



(a) Longitudinal



Alloy: 2024-T861

Stress Ratio: .50

Frequency: 200 cpm

Thickness: 1.60 mm (.063 inch)

Constraint: Stiffened

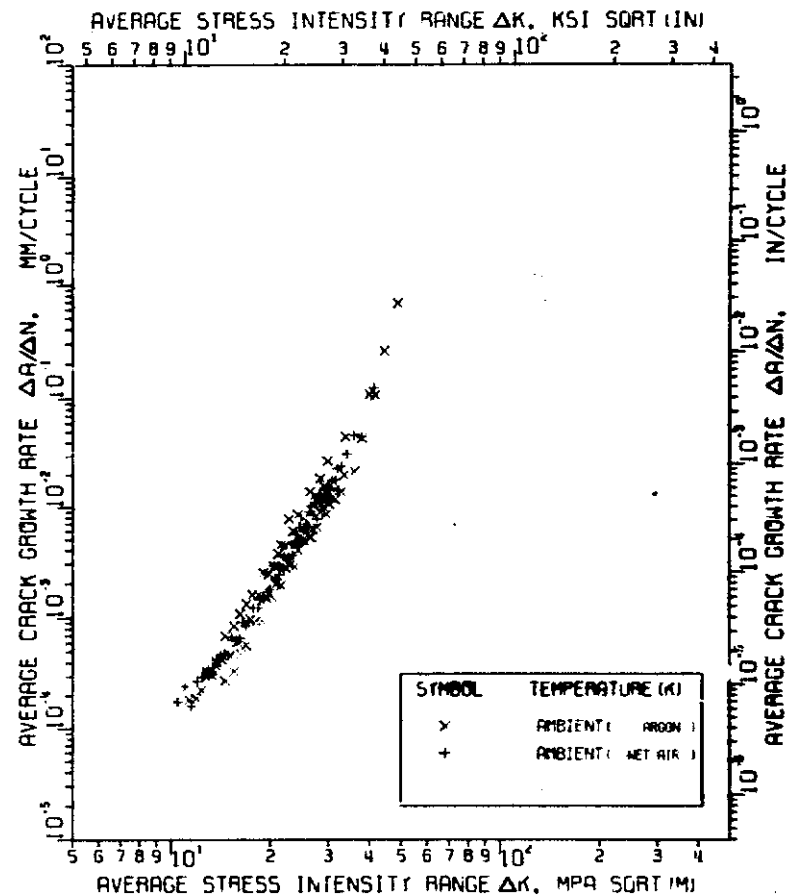
AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

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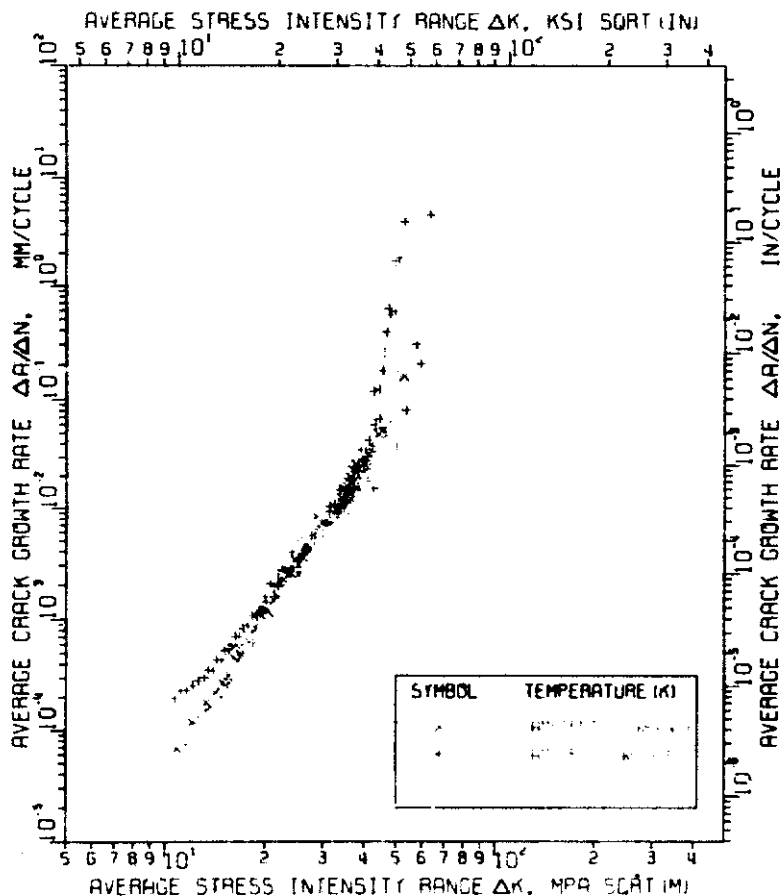
FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T861

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(b) Transverse



(a) Longitudinal



Alloy: 2024-T861

Stress Ratio: .05

Frequency: 200 cpm

Thickness: 1.60 mm (.063 inch)

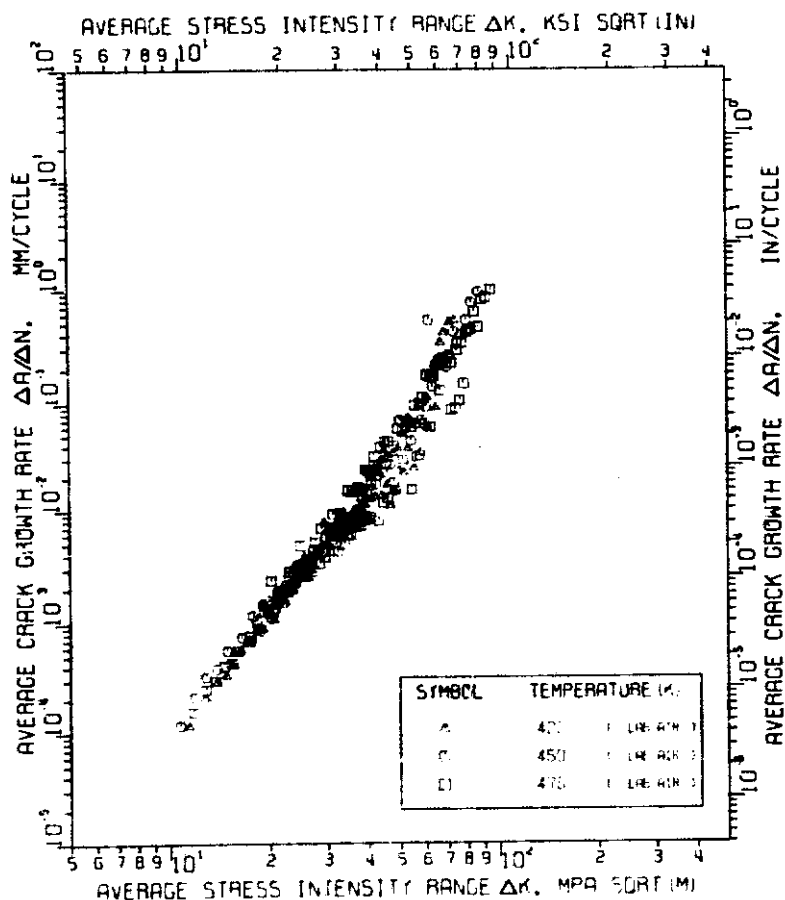
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AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

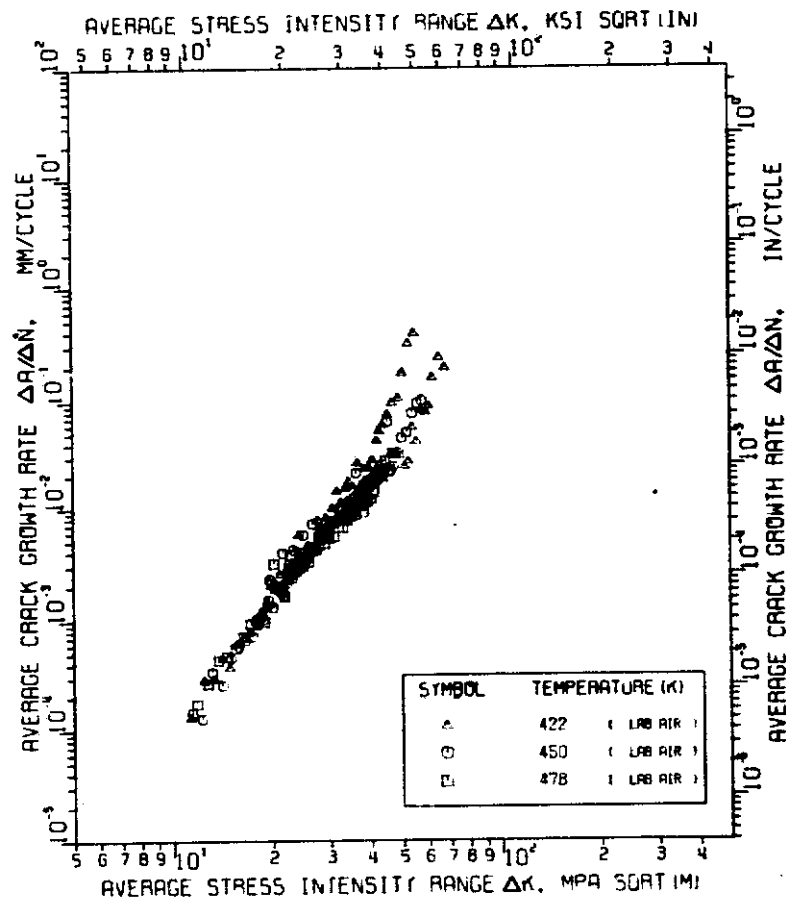
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FIGURE D1-6

(a) Longitudinal



(b) Transverse



Alloy: 2024-T861

Stress Ratio: .05

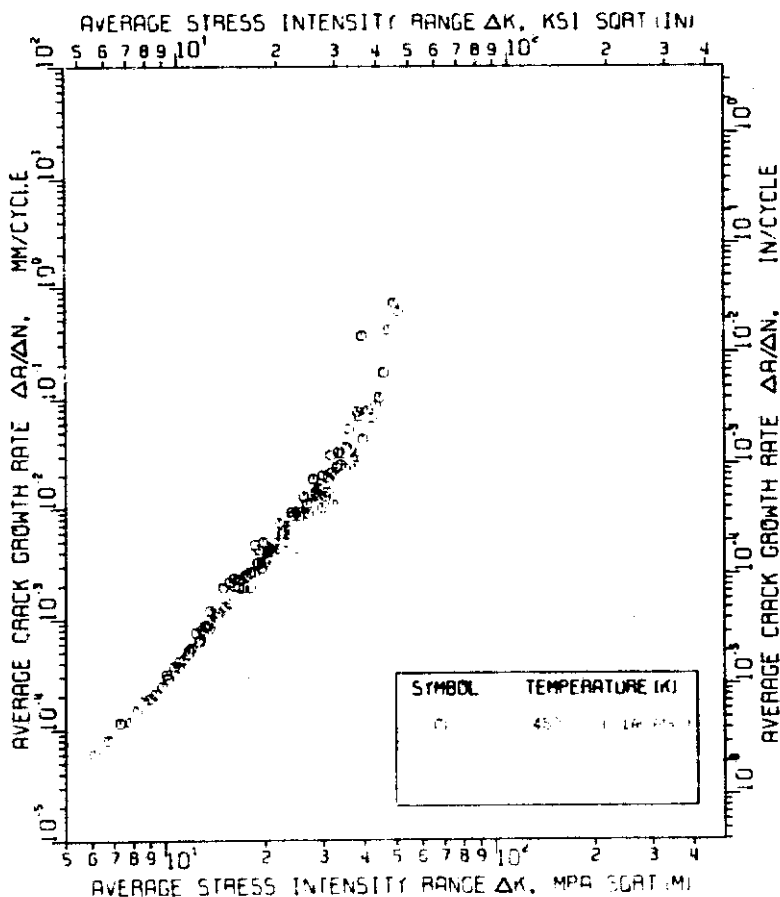
Frequency: 200 cpm

Thickness: 1.60 mm (.063 inch)

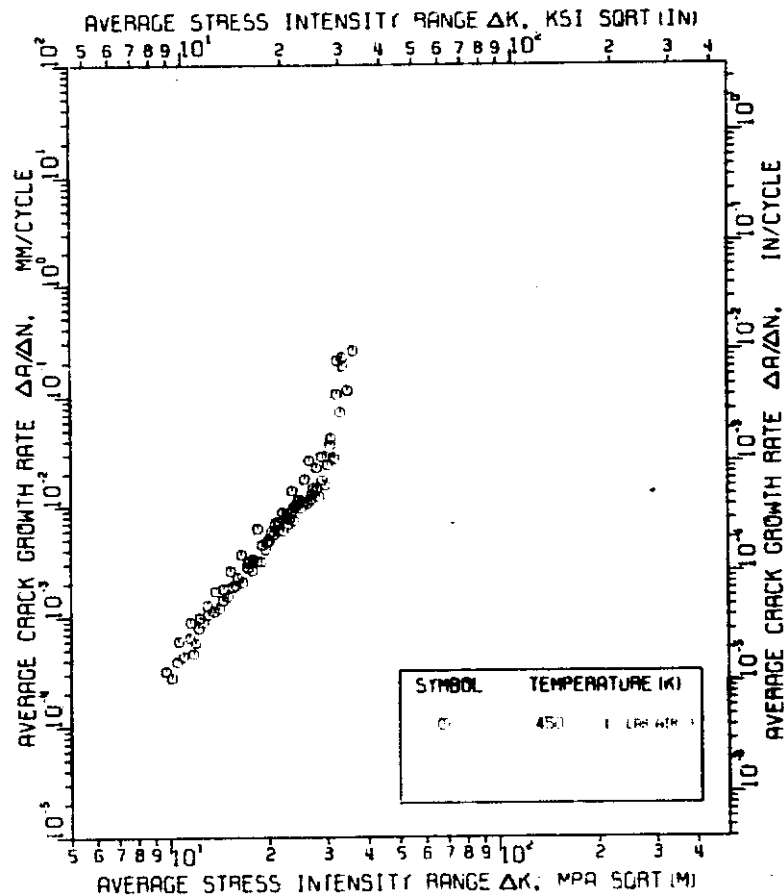
Constraint: Stiffened

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

(a) Longitudinal



(b) Transverse



Alloy: 2024-T861

Stress Ratio: .50

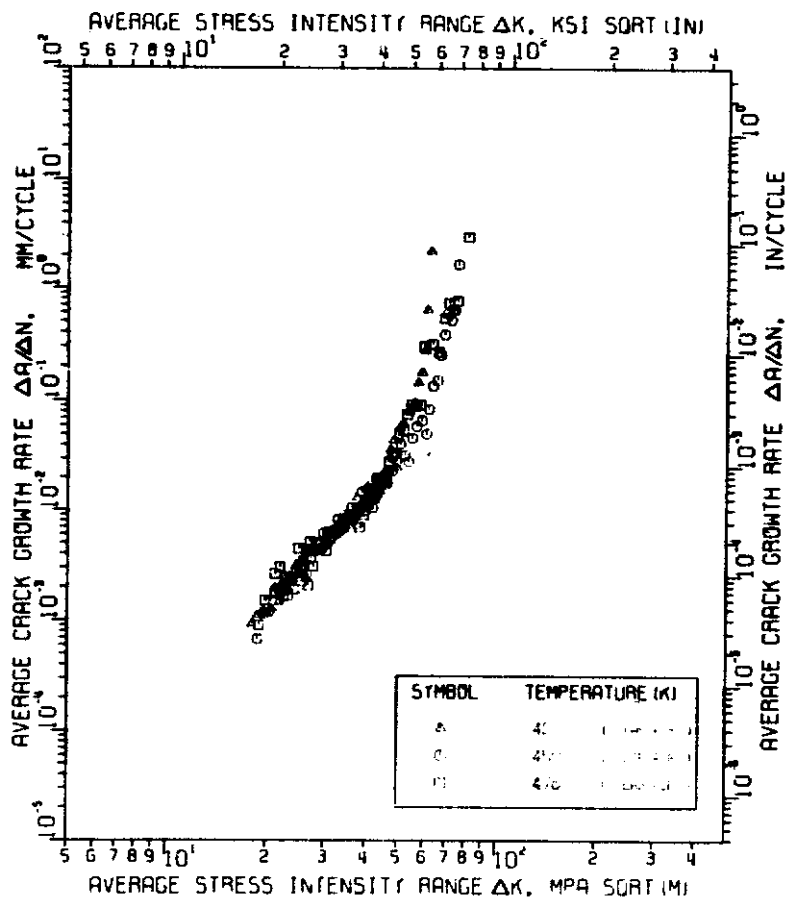
Frequency: 200 cpm

Thickness: 1.60 mm (.063 inch)

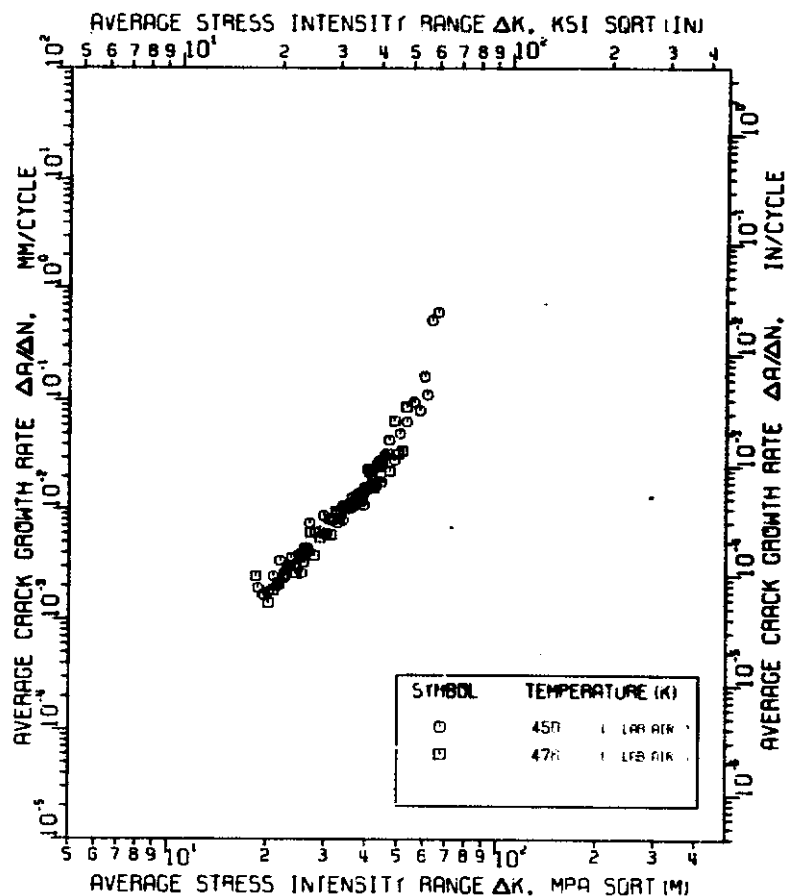
Constraint: Stiffened

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

(a) Longitudinal



(b) Transverse



Alloy: 2024-T861

Stress Ratio: .05

Frequency: 20G cpm

Thickness: 1.60 mm (.063 inch)

Constraint: Unstiffened

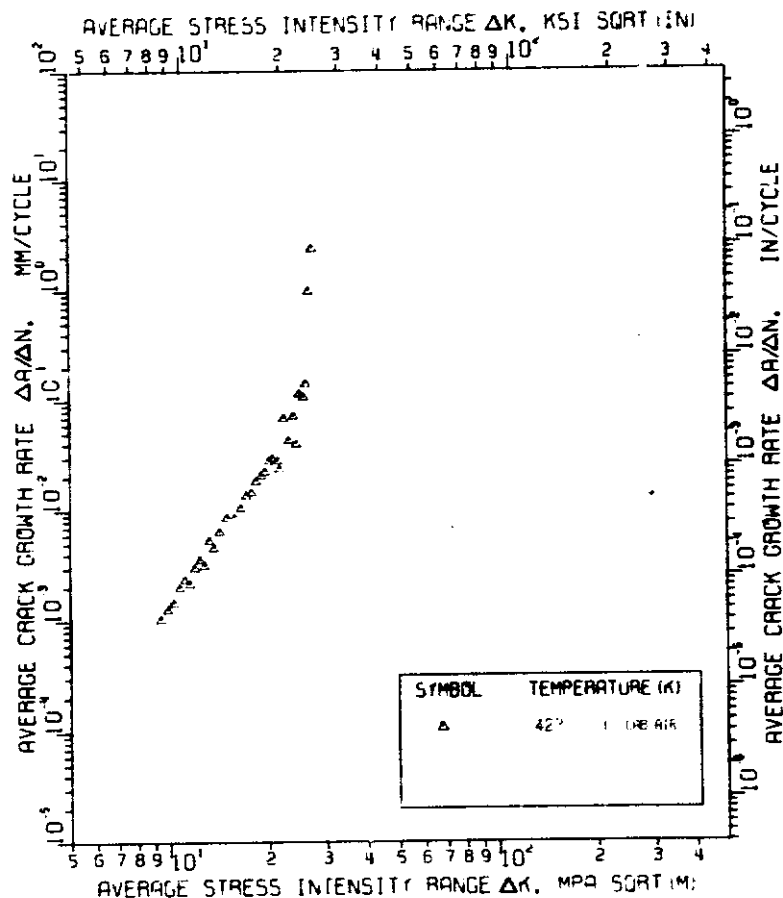
AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

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Transverse



Alloy: 2024-T861

Stress Ratio: .50

Frequency: 200 cpm

Thickness: 1.60 mm (.063 inch)

Constraint: Unstiffened

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

FIGURE D1-

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**FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851**

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**SECTION D2 - - FLAW GROWTH RATE DATA
FOR 3.18 mm (.125 INCH) THICK 2024-T861**

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FRACTURE MECHANICS DATA FOR
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TABLE D2-1. SUMMARY OF SPECIMEN TEST CONDITIONS FOR
200 CPM TESTS OF 3.18 mm (.125 INCH) THICK 2024-T861

<u>Test Temperature (°K)</u>	<u>Stress Ratio</u>	<u>Constraint</u>	<u>Test Direction</u>	<u>Specimen I.D.</u>	<u>Data Table No.</u>	<u>Figure No.</u>
144 (N ₂)	.05	Stiffened	L	125-2L2	D2-2	D2-1(a)
				125-1L2	D2-3	D2-1(a)
			T	125-4T2	D2-4	D2-1(b)
				125-6T9	D2-5	D2-1(b)
	.50	Stiffened	L	125-2L3	D2-6	D2-2(a)
				125-1L9	D2-7	D2-2(a)
			T	125-5T1	D2-8	D2-2(b)
				125-7T5	D2-9	D2-2(b)
	.05	Unstiffened	L	125-2L13	D2-10	D2-3(a)
				125-2L1	D2-11	D2-3(a)
			T	125-5T2	D2-12	D2-3(b)
				125-4T8	D2-13	D2-3(b)
298 (Argon)	.05	Stiffened	L	125-2L6	D2-14	D2-4(a)
				125-1L3	D2-15	D2-4(a)
				125-3L3	D2-16	D2-4(a)
			T	125-4T9	D2-17	D2-4(b)
				125-5T12	D2-18	D2-4(b)
				125-3T6	D2-19	D2-4(b)
				125-5T11	D2-20	D2-4(b)
	.50	Stiffened	L	125-1L8	D2-21	D2-5(a)
				125-1L12	D2-22	D2-5(a)
				125-2L14	D2-23	D2-5(a)
			T	125-3T10	D2-24	D2-5(b)
				125-4T11	D2-25	D2-5(b)
				125-5T3	D2-26	D2-5(b)
	.05	Unstiffened	L	U125-2L7	D2-27	D2-6(a)
				U125-1L13	D2-28	D2-6(a)
				U125-4L2	D2-29	D2-6(a)
			T	U125-6T5	D2-30	D2-6(b)
				U125-3T2	D2-31	D2-6(b)

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FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

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TABLE D2-1. (CONTINUED)

<u>Test Temperature (°K)</u>	<u>Stress Ratio</u>	<u>Constraint</u>	<u>Test Direction</u>	<u>Specimen I.D.</u>	<u>Data Table No.</u>	<u>Figure No.</u>
298 (Wet Air)	.05	Unstiffened	L	U125-1L10	D2-32	D2-6(a)
				U125-2L10	D2-33	D2-6(a)
				U125-5L1	D2-34	D2-6(a)
			T	U125-5T4	D2-35	D2-6(b)
				U125-6T6	D2-36	D2-6(b)
				U125-1T1	D2-37	D2-6(b)
422	.05	Stiffened	L	125-1L6	D2-38	D2-7(a)
				125-6L1	D2-39	D2-7(a)
			T	125-3T3	D2-40	D2-7(b)
				125-4T3	D2-41	D2-7(b)
	.05	Unstiffened	L	U125-1L11	D2-42	D2-9(a)
				U125-4T7	D2-43	D2-9(b)
	.05	Stiffened	L	125-1L14	D2-44	D2-7(a)
				125-6L6	D2-45	D2-7(a)
			T	125-3T8	D2-46	D2-7(b)
				125-4T10	D2-47	D2-7(b)
	.50	Stiffened	L	125-2L9	D2-48	D2-8(a)
				125-1L7	D2-49	D2-8(a)
450	.05	Unstiffened	L	U125-6L2	D2-52	D2-9(a)
				U125-2L8	D2-53	D2-9(a)
			T	125-5T5	D2-54	D2-9(b)
				U125-2T2	D2-55	D2-9(b)
	.05	Stiffened	L	125-1L4	D2-56	D2-7(a)
				125-1L5	D2-57	D2-7(a)
			T	125-5T7	D2-58	D2-7(b)
				125-5T9	D2-59	D2-7(b)
	.05	Unstiffened	L	U125-1L15	D2-60	D2-9(a)
				U125-5T10	D2-61	D2-9(b)

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TABLE D2-2

SPECIMEN NUMBER: 125-112						
SPECIMEN ORIENTATION: LONGITUDINAL						
CONSTRAINTS: NONE						
TEST TEMPERATURE: 7.25 MM (1.240 IN)						
SPECIMEN THICKNESS: 118.6 MPA (17.2 KSI)						
MAXIMUM STRESS: 37.68 MPA SORT(M) 34.29 KSI SORT(M)						
CYCLES TO FAILURE: 131 CYCLES PRIOR TO FAILURE						
K(MAX) 131 CYCLES PRIOR TO FAILURE						
CRACK LENGTH	MM	IN	CYCLES	DELTA(K)/DELTA(N)	DELTA(Δ)/DELTA(N)	DELTA(Δ)/DELTA(N)
8.77	.349		1	.133E-02	.4147E-04	19.18
9.59	.378		741	.1539E-02	.6044E-04	19.94
10.29	.405		1231	.2046E-02	.8063E-04	20.77
11.22	.442		1688	.2161E-02	.8530E-04	21.62
12.04	.474		2070	.3338E-02	.1314E-03	22.46
13.03	.513		2366	.4727E-02	.1861E-03	23.39
14.12	.556		2596	.5208E-02	.2051E-03	24.72
16.14	.635		2994	.1335E-01	.4175E-03	26.11
17.51	.689		3110	.8960E-02	.3491E-03	27.34
18.54	.730		3233	.1122E-01	.4410E-03	28.39
20.19	.795		3393	.1643E-01	.6467E-03	29.25
21.67	.853		3471	.2186E-01	.8035E-03	30.55
24.04	.948		3580	.2563E-01	.1609E-02	32.05
26.67	1.031		3642	.3372E-01	.1213E-02	33.33
29.96	1.161		3684	.7521E-01	.1386E-02	34.16
28.72	1.131		3714	.6797E-01	.2673E-02	35.22
31.48	1.220		3767			32.15

TABLE D2-3

SPECIMEN NUMBER: 125-112						
SPECIMEN ORIENTATION: LONGITUDINAL						
CONSTRAINTS: NONE						
TEST TEMPERATURE: 7.25 MM (1.240 IN)						
SPECIMEN THICKNESS: 167.3 MPA (24.5 KSI)						
MAXIMUM STRESS: 56.72 MPA SORT(M) 51.62 KSI SORT(M)						
CYCLES TO FAILURE: 1 CYCLES PRIOR TO FAILURE						
K(MAX) 1 CYCLES PRIOR TO FAILURE						
CRACK LENGTH	MM	IN	CYCLES	DELTA(K)/DELTA(N)	DELTA(Δ)/DELTA(N)	DELTA(Δ)/DELTA(N)
3.96	.156		1	.6371E-01	.2583E-04	18.64
4.07	.176		816	.1144E-02	.4530E-04	21.73
5.44	.214		1497	.2520E-02	.1134E-03	21.52
6.09	.240		1932	.3786E-02	.1294E-03	22.99
6.96	.276		2136	.6102E-02	.2434E-03	24.57
7.93	.312		2333	.6921E-02	.2720E-03	25.96
8.07	.321		2454	.1230E-01	.4472E-03	27.43
9.03	.347		2534	.1174E-01	.4621E-03	28.77
11.52	.454		2612	.1533E-01	.6191E-03	29.61
11.02	.436		2745	.2779E-01	.1194E-02	31.67
12.10	.472		2145	.1333E-01	.5327E-03	31.76
F 17.70	.699		2712	.6151E-01	.2611E-02	33.41
F 14.61	.575		2702	.2117E-01	.8331E-03	34.96
F 15.24	.601		2792	.3325E-01	.3791E-03	36.44
F 17.14	.675		2812	.6151E-01	.2531E-02	39.78
F 19.41	.725		2832	.1101E-01	.4333E-02	41.96
F 20.07	.791		2807	.1143E-01	.4501E-02	41.34
F 21.21	.835		2847	.1774E-01	.7101E-02	42.46
F 22.93	.901		2867	.2341E-01	.1101E-01	44.41
F 24.26	.955		2872	.6151E-01	.2602E-01	45.56
F 25.53	1.004		2874	.9521E-01	.3751E-01	47.21
F 27.03	1.061		2876	.6985E-01	.2751E-01	48.78
F 28.93	1.135		2878	.1143E-01	.4501E-01	49.37
F 29.37	1.180		2879	.1651E-01	.6511E-01	51.27
F 31.02	1.245		2887	.2332E-01	.8101E-01	52.96
F 33.05	1.305		2891			48.20

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TABLE D2-4

SPECIMEN NUMBER:				125-672	
SPECIMEN ORIENTATION:				TRANSMVERSE	
CONSTRAINTS:				STRESS	
TEST TEMPERATURE:				NITROGEN	
SPECIMEN THICKNESS:				3.24 MM (1.274 IN)	
MAXIMUM STRESS:				116.6 MPa (16.7 KSI)	
FREQUENCY:				200 CPM	
CYCLES TO FAILURE:				1561 CYCLES	
KIMAX:				29.96 MPa SORTIME 27.21 KSI SORTIME	
KIMAX:				53 CYCLES PRIOR TO FAILURE	
CRACK LENGTH	IN	CYCLES	DELTA KIMAX/DELTA IN	DELTA STRESS INTENSITY	
MM			MPa/CYCLE	IN/CYCLE	MPa SORTIME KSI SORTIME
8.59	.342	1	.2396E-02	.1253E-04	19.15 17.43
9.64	.381	456	.3169E-02	.1247E-03	20.12 18.31
10.56	.416	745	.5220E-02	.1976E-03	20.99 19.11
11.41	.449	915	.4065E-02	.1916E-03	21.05 19.09
12.36	.487	1111	.0221E-02	.3263E-03	22.74 21.72
13.40	.528	1296	.1426E-01	.5613E-03	23.61 21.49
14.78	.582	1298	.1474E-01	.5709E-03	24.60 22.39
15.71	.618	1399	.3862E-01	.1142E-02	25.50 23.21
16.46	.648	1425	.4382E-01	.1701E-02	26.41 24.54
17.97	.708	1467	.5111E-01	.2050E-02	27.71 25.22
19.41	.768	1491			

TABLE D2-5

SPECIMEN NUMBER:				125-670	
SPECIMEN ORIENTATION:				TRANSMVERSE	
CONSTRAINTS:				STRESS	
TEST TEMPERATURE:				NITROGEN	
SPECIMEN THICKNESS:				3.25 MM (1.279 IN)	
MAXIMUM STRESS:				166.4 MPa (23.9 KSI)	
FREQUENCY:				200 CPM	
CYCLES TO FAILURE:				1097 CYCLES	
KIMAX:				32.62 MPa SORTIME 27.32 KSI SORTIME	
KIMAX:				45 CYCLES PRIOR TO FAILURE	
CRACK LENGTH	IN	CYCLES	DELTA KIMAX/DELTA IN	DELTA STRESS INTENSITY	
MM			MPa/CYCLE	IN/CYCLE	MPa SORTIME KSI SORTIME
4.27	.168	1	.1472E-02	.5821E-04	18.98 17.28
5.48	.215	149	.4489E-02	.1767E-03	21.36 18.96
6.18	.243	794	.0547E-02	.3522E-03	22.71 20.66
7.19	.283	676	.1689E-01	.5564E-03	24.44 22.24
8.29	.324	672	.2747E-01	.1481E-02	26.19 23.46
9.47	.373	1115	.2914E-01	.1104E-02	27.40 25.70
10.57	.413	1052			

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TABLE D2-6

SPECIMEN NUMBER: 1
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINTS: STIFFENED
TEST TEMPERATURE: 100.0 K
SPECIMEN THICKNESS: 1.25 IN
MAXIMUM STRESS: 116.2 MPa (16.7 KSI)
R-RATIO: 0.2
CYCLES TO FAILURE: 11740
FREQUENCY: 200 CPM
K(MIN): 143 CYCLES PRIOR TO FAILURE
46.13 MPa (SORTING) 41.49 KSI (SORTING)

CRACK LENGTH MM IN	CYCLES	DELTA(S)/DELTA(E) MM/CYCLE IN/CYCLE	DELTA(Stress Intensity) MPa (SORTING) KSI (SORTING)
11.71	430	.755E-03	.277E-04
11.41	465	.493E-03	.190E-04
12.49	491	.965E-03	.300E-04
13.29	523	.997E-03	.300E-04
14.45	559	.873E-03	.349E-04
14.91	587	.129E-02	.510E-04
15.71	614	.172E-02	.674E-04
16.72	638	.144E-02	.584E-04
18.73	710	.227E-02	.897E-04
19.74	741	.216E-02	.852E-04
21.73	848	.250E-02	.987E-04
22.97	913	.447E-02	.176E-03
24.47	941	.468E-02	.185E-03
26.18	1031	.449E-02	.192E-03
27.74	1047	.712E-02	.283E-03
29.71	1150	.772E-02	.304E-03
31.72	1217	.761E-02	.302E-03
32.97	1240	.112E-01	.441E-03
34.71	1175	.114E-01	.432E-03
36.71	1170	.154E-01	.391E-03
38.41	1141	.252E-01	.593E-03
39.71	1149	.322E-01	.827E-03
41.39	1151	.467E-01	.184E-02
41.74	1157		

TABLE D2-7

SPECIMEN NUMBER: 1
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINTS: STIFFENED
TEST TEMPERATURE: 100.0 K
SPECIMEN THICKNESS: 1.25 IN
MAXIMUM STRESS: 145.2 MPa (20.9 KSI)
R-RATIO: 0.2
CYCLES TO FAILURE: 11740
FREQUENCY: 200 CPM
K(MIN): 1 CYCLES PRIOR TO FAILURE
46.49 MPa (SORTING) 42.45 KSI (SORTING)

CRACK LENGTH MM IN	CYCLES	DELTA(S)/DELTA(E) MM/CYCLE IN/CYCLE	DELTA(Stress Intensity) MPa (SORTING) KSI (SORTING)
11.71	430	.213E-02	.633E-04
12.49	465	.177E-02	.472E-04
13.29	491	.224E-02	.602E-04
14.45	559	.334E-02	.131E-03
14.91	587	.418E-02	.160E-03
15.71	614	.471E-02	.185E-03
16.72	638	.547E-02	.245E-03
18.73	710	.643E-02	.293E-03
19.74	741	.814E-02	.316E-03
21.73	848	.121E-01	.477E-03
22.97	913	.141E-01	.573E-03
24.47	941	.141E-01	.573E-03
26.18	1031	.144E-01	.573E-03
27.74	1047	.144E-01	.573E-03
29.71	1150	.144E-01	.573E-03
31.72	1217	.144E-01	.573E-03
32.97	1240	.144E-01	.573E-03
34.71	1175	.144E-01	.573E-03
36.71	1170	.144E-01	.573E-03
38.41	1141	.144E-01	.573E-03
39.71	1149	.144E-01	.573E-03
41.39	1151	.144E-01	.573E-03
41.74	1157	.144E-01	.573E-03

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TABLE D2-8

SPECIMEN NUMBER: 125-775		ALLOY TYPE: 7075-T6		TRANSVERSE	
SPECIMEN CONFIGURATION: TRANSVERSE		CONSTRAINTS: STRESS		STRESS	
TEST TEMPERATURE: 100-8 K		SPECIMEN THICKNESS: 3.24 MM (1.275 IN)		112.4 MPA (17.2 KSI)	
FATIGUE STRESS: 112.4 MPA (17.2 KSI)		FREQUENCY: 200 CPS		1250 CYCLES	
CYCLES TO FAILURE: 1250 CYCLES		MINIMUM: 1 CYCLE PRIOR TO FAILURE		45.17 MPA SORT(M); 37.44 KSI SORT(M)	

CRACK LENGTH	IN	CYCLES	DELTA(KA)/DELTA(N)	DELTA(STRESS INTENSIVITY)		
MM			MPA/CYCLE	KSI SORT(M)		
11.36	.447	1334	.5647E-01	.2157E-04	11.35	11.95
11.76	.467	1334	.1401E-12	.5831E-04	11.52	10.40
12.49	.492	2124	.2010E-02	.7923E-04	11.72	10.95
13.32	.512	2412	.1986E-02	.6243E-04	12.11	11.32
13.31	.523	2197	.3177E-02	.1231E-03	12.35	11.26
14.15	.553	2817	.3344E-02	.1317E-03	12.71	11.56
14.46	.564	3175	.3463E-02	.1441E-03	13.16	11.90
15.53	.616	3234	.3433E-02	.1350E-03	13.43	12.19
16.41	.646	3433	.5578E-02	.2195E-03	13.68	12.45
16.38	.669	3578	.5491E-02	.2162E-03	13.96	12.70
17.72	.697	3750	.5594E-02	.2204E-03	14.25	12.97
18.43	.725	3851	.4973E-02	.2049E-03	14.55	13.24
19.17	.755	4096	.4379E-01	.4652E-03	14.91	13.57
20.25	.797	4196	.4803E-02	.3872E-03	15.52	14.12
20.29	.877	4711	.2131E-01	.8345E-03	16.20	14.74
21.16	.939	4375	.3109E-01	.1217E-02	16.94	15.32
22.75	1.014	4615	.4324E-01	.1979E-02	17.49	15.91
23.67	1.042	4671	.1322E-01	.5203E-02	18.14	16.58
24.72	1.044	4644	.1143E-01	.4500E-02	18.77	17.08
30.16	1.216	4614	.1316E-01	.4617E-02	19.14	17.41
31.44	1.25	4614	.1493E-01	.6647E-02	19.44	17.73
32.99	1.275	4614	.4325E-01	.3757E-01	19.47	18.17
34.41	1.37	4614	.4597E-01	.7501E-01	20.44	18.66
35.09	1.38	4617				

TABLE D2-9

SPECIMEN NUMBER: 125-775				200 CPS	
SPECIMEN CONFIGURATION: TRANSVERSE				104.4 MPA (15.9 KSI)	
CONSTRAINTS: STRESS				1250 CYCLES	
TEST TEMPERATURE: 100-8 K				1250 CYCLES	
SPECIMEN THICKNESS: 3.25 MM (1.280 IN)				1250 CYCLES	
FATIGUE STRESS: 104.4 MPA (15.9 KSI)				1250 CYCLES	
FREQUENCY: 200 CPS				1250 CYCLES	
CYCLES TO FAILURE: 1250 CYCLES				1250 CYCLES	
MINIMUM: 1 CYCLE PRIOR TO FAILURE: 45.17 MPA SORT(M); 37.21 KSI SORT(M)				1250 CYCLES	

CRACK LENGTH MM IN	CYCLES	DELTA(KA)/DELTA(N) MM/CYCLE IN/CYCLE	DELTA(STRESS INTENSIVITY) MPA SORT(M) KSI SORT(M)
6.31	217	1	11.29
6.41	232	392	12.71
7.13	241	187	12.73
8.71	316	828	13.39
10.71	383	898	13.92
11.17	399	983	14.44
11.17	377	1071	15.13
11.16	443	1159	15.94
11.44	440	1239	16.61
F	11.71	1253	17.35
F	14.77	1262	17.26
F	14.11	1274	17.24
F	18.16	1284	18.22
F	19.43	1286	19.40
F	21.71	1297	21.86

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TABLE D2-10

SPECIMEN NUMBER: 2024-T801						
ALLOY TYPE: 2024-T801						
SPECIMEN ORIENTATION: LONGITUDINAL						
CORROSION: UNCORRODED						
ENVIRONMENT: NITROGEN						
TEST TEMPERATURE: 100°F						
SPECIMEN THICKNESS: 1.25 MM (0.049 IN)						
SPECIMEN THICKNESS: 14.5 MPa (21.0 KSI)						
HAZARD: 200 CIP						
FREQUENCY: 200 CIP						
CYCLES TO FAILURE: 33.30 MPA SORTIME: 30.34 KSI SORTIME						
(KIMAY) 100 CYCLES PRIOR TO FAILURE						
CRACK LENGTH	IN	CYCLES	DELTA(I)/DELTA(II)	IN/CYCLE	DELTA(III) STRESS INTENSIVITY	MPa SORTIME
9.15	.348	491	.1487E-02	.5735E-04	19.20	17.48
9.56	.376	799	.1132E-02	.4061E-04	19.74	17.96
9.99	.389	799	.2133E-02	.8397E-04	20.24	18.42
10.35	.415	1111	.1094E-02	.7455E-04	20.93	19.05
11.29	.444	1511	.2464E-02	.1169E-03	21.60	19.65
11.93	.470	1729	.2049E-02	.1121E-03	22.16	20.17
12.50	.492	1914	.4364E-02	.1721E-03	22.71	20.67
13.14	.517	2066	.4725E-02	.1860E-03	23.25	21.16
13.70	.539	2184	.4423E-02	.1742E-03	23.72	21.59
14.22	.561	2332	.5506E-02	.2190E-03	24.24	22.10
14.62	.591	2445	.7572E-02	.2991E-03	24.84	22.64
15.03	.615	2525	.9914E-02	.3746E-03	25.35	23.07
15.17	.637	2562	.9569E-02	.3767E-03	25.91	23.58
15.99	.669	2668	.9616E-02	.3786E-03	26.43	24.05
17.46	.698	2717	.1432E-01	.5638E-03	26.80	24.46
19.14	.714	2764	.1120E-01	.4461E-03	27.39	24.93
19.80	.741	2823	.1664E-01	.6549E-03	28.22	25.60
20.31	.808	2914	.2299E-01	.9033E-03	29.35	26.71
21.83	.860	2980	.2651E-01	.1044E-02	30.35	27.62
23.80	.909	3027	.2068E-01	.1109E-02	31.25	28.44
24.46	.961	3074				

TABLE D2-11

SPECIMEN NUMBER: 2124-T801						
ALLOY TYPE: 2124-T801						
SPECIMEN ORIENTATION: LONGITUDINAL						
CORROSION: UNCORRODED						
ENVIRONMENT: NITROGEN						
TEST TEMPERATURE: 100°F						
SPECIMEN THICKNESS: 1.25 MM (0.049 IN)						
SPECIMEN THICKNESS: 14.5 MPa (21.0 KSI)						
HAZARD: 200 CIP						
FREQUENCY: 200 CIP						
CYCLES TO FAILURE: 57.46 MPA SORTIME: 52.29 KSI SORTIME						
(KIMAY) 1 CYCLE PRIOR TO FAILURE						
CRACK LENGTH	IN	CYCLES	DELTA(I)/DELTA(II)	IN/CYCLE	DELTA(III) STRESS INTENSIVITY	MPa SORTIME
4.71	.140	731	.1291E-02	.5043E-04	19.64	17.69
4.11	.231	731	.1725E-02	.6791E-04	21.14	19.24
4.17	.231	1169	.2790E-02	.1094E-03	22.62	20.99
4.73	.266	1457	.4379E-02	.1724E-03	23.74	21.62
7.71	.714	1564	.6120E-02	.2362E-03	24.44	22.46
7.42	.137	1564	.8135E-02	.3262E-03	25.59	23.20
9.17	.320	1724	.4679E-02	.3417E-03	26.77	24.08
4.73	.140	1742	.1717E-01	.5170E-03	27.20	24.75
4.41	.137	1874	.1434E-01	.4416E-03	28.73	25.69
10.14	.403	1874	.1854E-01	.7319E-03	29.34	26.74
11.29	.434	1922	.2154E-01	.8093E-03	30.36	27.63
11.76	.468	1965	.2744E-01	.1093E-02	31.75	28.44
12.17	.494	1977	.3324E-01	.1308E-02	32.42	29.49
13.17	.526	2027	.3394E-01	.1316E-02	33.52	30.49
14.11	.555	2029	.4731E-01	.2254E-02	34.53	31.42
14.11	.531	2045	.5154E-01	.2029E-02	35.97	32.73
14.71	.657	2174	.1143E-01	.4500E-02	37.44	34.21
14.71	.635	2174	.1744E-01	.6375E-02	38.90	35.68
19.14	.741	2197	.3144E-01	.1200E-01	40.44	36.84
20.57	.860	2137	.4333E-01	.2175E-01	42.54	38.72
22.45	.901	2131	.7197E-01	.2833E-01	44.84	40.42
25.15	.931	2134	.8254E-01	.3250E-01	46.73	42.52
26.41	1.145	2184	.9144E-01	.1200E-02	44.47	44.57
28.44	1.175	2137	.4677E-01	.1800E-01	52.41	47.78
34.42	1.145	2134				

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TABLE D2-12

SPECIMEN NUMBER			U125-672		
SPECIMEN CHARACTERISTICS			U125-672		
TEST TEMPERATURE			U125-672		
SPECIMEN THICKNESS			U125-672		
FATIGUE			U125-672		
CYCLES TO FAILURE			U125-672		
KINAVI 67 CYCLES PRIOR TO FAILURE			U125-672		
20.67 MPa SORTING			U125-672		
20.10 MPa SORTING			U125-672		

CRACK LENGTH	CYCLES	DELTA(SI)/DELTA(SI)	DELTA(SI)/DELTA(SI)	CRACK LENGTH	DELTA(SI)/DELTA(SI)
0.46	1	.1796E-02	.0229E-04	10.93	17.23
0.23	270	.1197E-02	.7776E-04	19.56	17.00
0.45	640	.3791E-02	.1477E-03	20.24	18.42
10.50	801	.4175E-02	.1044E-03	18.92	19.04
11.22	1034	.6931E-02	.2729E-03	21.58	19.57
11.79	1117	.8910E-02	.3170E-03	22.17	20.10
12.65	1223	.1303E-01	.6245E-03	22.04	20.83
13.39	1291	.1145E-01	.6788E-03	23.54	21.43
14.12	1355	.1971E-01	.7761E-03	24.68	22.39
15.45	1447	.2793E-01	.1095E-02	25.04	23.52
17.14	1489	.3803E-01	.1520E-02	26.90	24.30
19.21	1918				

TABLE D2-13

SPECIMEN NUMBER			U125-678		
SPECIMEN CHARACTERISTICS			U125-678		
TEST TEMPERATURE			U125-678		
SPECIMEN THICKNESS			U125-678		
FATIGUE			U125-678		
CYCLES TO FAILURE			U125-678		
KINAVI 45 CYCLES PRIOR TO FAILURE			U125-678		
20.00 MPa SORTING			U125-678		
22.17 MPa SORTING			U125-678		
CRACK LENGTH			IN		
IN			IN		
CYCLES			CYCLES		
DELTA(SI)/DELTA(SI)			DELTA(SI)/DELTA(SI)		
IN/CVLE			IN/CVLE		
MPa SORTING			MPa SORTING		
KSI SORTING			KSI SORTING		
.177			.1692E-02		
.218			.2894E-02		
.243			.4133E-02		
.250			.9822E-02		
.267			.9518E-02		
.304			.2277E-01		
.341			.3291E-01		
.355					

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FRACTURE MECHANICS DATA FOR
2024-T061 AND 2124-T051

TABLE D2-14

SPECIMEN NUMBER: 125-2LE
SPEICMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: STIFFENEC
TEST EQUIPMENT: ARCHE
SPECIMEN TYPE: 2024-T061
MAXIMUM STRESS: 3.75 MM 11.380 MPa
FREQUENCY: 75.0 MPa 11.000 KSI
CYCLES TO FAILURE: 203 Cycles
MINIMUM 2 Cycles PRIOR TO FAILURE: 62.67 MPa SORTIME 55.21 KSI SORTIME

CRACK LENGTH	IN	CM	DELTA I / DELTA II	IN / CM	DELTA STRESS INTENSITY	MPa (KSI)	MPa (KSI)
4.91	.272	6.94	.858E-04	.3527E-05	10.73	9.77	
7.42	.290	58.96	.7314E-04	.3076E-05	11.19	10.18	
4.15	.321	160.93	.6739E-04	.2753E-05	11.47	10.82	
4.79	.34F	742.74	.1209E-03	.5103E-05	12.13	11.04	
5.73	.374	290.44	.1102E-03	.4759E-05	12.56	11.43	
11.4	.397	162.38	.1061E-03	.7327E-05	12.79	11.82	
1.44	.428	790.21	.1724E-03	.6794E-05	13.44	12.24	
11.15	.435	474.32	.1661E-03	.7724E-05	13.90	12.45	
30.45	.438	477.32	.2711E-03	.1047E-04	14.14	13.05	
13.15	.515	706.53	.3585E-03	.1411E-04	14.88	13.46	
14.17	.518	533.74	.3767E-03	.1443E-04	15.32	13.94	
14.72	.547	500.39	.3772E-03	.1444E-04	15.79	14.37	
15.43	.607	587.44	.4851E-03	.1835E-04	16.30	14.83	
16.72	.648	597.65	.6781E-03	.2670E-04	16.77	15.19	
17.71	.645	601.7	.4667E-03	.1835E-04	17.31	15.53	
19.72	.717	624.35	.6002E-03	.2623E-04	17.41	15.84	
19.71	.744	476.57	.8227E-03	.3235E-04	17.37	16.29	
21.72	.798	551.11	.8644E-03	.3482E-04	14.54	15.41	
21.72	.877	448.27	.1751E-02	.4925E-04	15.41	17.59	
23.71	.976	447.37	.1485E-02	.5861E-04	20.77	19.40	
25.41	1.016	497.37	.1987E-02	.7409E-04	21.34	19.19	
27.41	1.043	707.64	.2182E-02	.8590E-04	21.40	19.84	
29.10	1.145	714.33	.2524E-02	.9447E-04	22.45	20.47	
1.44	1.214	771.45					
32.74	1.275	775.61	.2584E-02	.1175E-03	27.17	21.04	
33.1	1.323	727.77	.4415E-02	.1714E-03	27.60	21.56	
35.27	1.345	733.16	.3714E-02	.1463E-03	24.70	22.11	
36.43	1.451	731.44	.4234E-02	.1667E-03	24.94	22.69	
39.14	1.513	730.72	.5402E-02	.2127E-03	25.54	23.26	
39.34	1.573	747.42	.5923E-02	.2291E-03	26.17	23.82	
41.72	1.617	744.01	.7137E-02	.2813E-03	26.40	24.39	
41.72	1.617	744.01	.5711E-02	.2244E-03	27.41	24.94	
41.72	1.615	747.24	.4574E-02	.3776E-03	28.07	25.50	
44.54	1.724	740.18	.4137E-02	.3755E-03	28.64	26.07	
46.22	1.874	757.75	.1108E-01	.3966E-03	29.24	26.51	
47.49	1.978	752.24	.1270E-01	.5002E-03	29.44	27.15	
49.77	1.934	753.44	.1163E-01	.4401E-03	30.44	27.71	
50.74	1.934	744.77	.1170E-01	.5793E-03	30.97	28.19	
51.41	2.044	750.41	.1463E-01	.5754E-03	31.44	28.65	
51.73	2.138	754.55	.1461E-01	.5754E-03	32.14	29.21	
54.74	2.143	757.48	.1600E-01	.7509E-03	32.59	29.75	
56.71	2.213	754.35	.2155E-01	.9271E-03	33.15	30.35	
58.17	2.231	759.14	.1774E-01	.7000E-03	34.17	31.05	
58.44	2.346	760.14	.2661E-01	.1044E-02	35.04	31.93	
62.74	2.471	761.23	.3556E-01	.1400E-02	36.07	32.83	
64.32	2.540	761.71	.3944E-01	.1400E-02	36.45	33.53	
65.74	2.610	762.21	.4314E-01	.1700E-02	37.71	34.33	
68.45	2.635	762.71	.6033E-01	.2374E-02	38.77	35.28	
70.47	2.740	763.13	.5080E-01	.2000E-02	39.41	36.27	
72.47	2.870	763.51	.7620E-01	.3000E-02	40.45	37.16	
75.14	2.950	763.83	.1016E-00	.4000E-02	42.14	38.39	
78.23	3.130	764.13	.1397E-00	.5509E-02	43.78	39.77	
81.33	3.190	764.33	.1270E-00	.5000E-02	44.97	40.93	
82.93	3.255	764.45	.2667E-01	.1051E-01	46.24	42.18	
84.60	3.370	764.58	.3410E-01	.1500E-01	47.50	43.32	
87.50	3.445	764.63	.3817E-01	.1500E-01	48.53	44.18	
88.55	3.491	764.66	.1206E-01	.4750E-01	49.44	45.18	

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F	91.06	3.985	76468	.7444E+00	.3088E-01	51.19	45.32
F	93.36	3.675	76471	.9737E+00	.3033E-01	52.99	48.23
F	96.27	3.798	76476	.1185E+01	.7588E-01	56.77	49.84
F	98.17	3.865	76475	.2667E+01	.1058E+00	56.55	51.46
F	103.06	3.978	76476				

TABLE D2-15

SPECIMEN NUMBER: 125-1L3
 ALLOY TYPE: 2024-T861
 SPECIMEN ORIENTATION: LONGITUDINAL
 CONSTRAINT: STIFFNESS
 SURFACE: SPONGE
 TEST TEMPERATURE: 303° K
 SPECIMEN THICKNESS: 3.75 MM (.1280 IN)
 MAXIMUM STRESS: 118.6 MPa (17.2 KSI)
 RATIO: 200
 FREQUENCY: 775 CYCLES
 CYCLES TO FAILURE: 22 CYCLES PRIOR TO FAILURE
 K(MAV): 49.70 MPa SQRT(IN) (45.23 KSI SQRT(IN))

CRACK LENGTH MM	IN	CYCLES	DELTA K(MAV)/DELTA IN MPa/CYCLE	DELTA K(MAV)/DELTA IN KSI/CYCLE	DELTA STRESS INTENSIVITY MPa SQRT(IN)	DELTA STRESS INTENSIVITY KSI SQRT(IN)
2.14	.232	1	.7322E-03	.2883E-04	15.92	14.40
6.06	.262	104	.8791E-03	.3461E-04	16.77	15.06
7.07	.278	151	.9567E-03	.3710E-04	17.15	15.61
7.67	.301	2526	.1129E-02	.4444E-04	17.87	16.26
9.32	.327	3141	.1401E-02	.5518E-04	19.71	17.93
9.17	.361	3721	.1314E-02	.4779E-04	19.49	17.74
10.1	.386	4261	.1729E-02	.6805E-04	20.39	18.41
11.1	.418	4746	.2324E-02	.1033E-03	20.99	19.11
11.36	.447	4934	.1855E-02	.7316E-04	21.57	19.63
11.91	.465	5716	.2797E-02	.1131E-03	22.14	20.15
12.09	.495	5513	.3611E-02	.1422E-03	22.91	20.75
13.26	.522	5771	.3993E-02	.1577E-03	23.42	21.11
13.48	.551	5491	.4471E-02	.1763E-03	24.11	21.94
14.45	.595	6174	.4891E-02	.1926E-03	24.79	22.50
15.44	.638	6130	.5733E-02	.2261E-03	25.27	22.96
16.44	.632	6370	.5107E-02	.2011E-03	25.67	23.36
16.63	.661	6335	.5923E-02	.2332E-03	26.12	23.77
17.18	.691	6545	.7234E-02	.2843E-03	26.66	24.26
17.87	.704	6611	.6931E-02	.2729E-03	27.13	24.87
19.31	.744	6740	.9474E-02	.3839E-03	28.27	25.72
21.33	.800	6834	.1187E-01	.4673E-03	29.34	26.72
21.85	.890	7034	.1474E-01	.5811E-03	31.37	27.64
23.13	.911	7124	.1416E-01	.5573E-03	31.91	28.58
24.77	.975	7200	.1533E-01	.6159E-03	32.49	29.51
26.11	1.027	7326	.2374E-01	.1171E-02	33.48	30.47
27.44	1.038	7346	.1997E-01	.7671E-03	34.61	31.49
28.46	1.104	7409	.4243E-01	.1675E-02	35.91	32.73
29.25	1.202	7533	.2112E-01	.8277E-03	37.11	33.78
30.44	1.311	7577	.4914E-01	.1944E-02	39.09	34.66
33.23	1.392	7613	.4215E-01	.1657E-02	39.27	35.74
36.79	1.444	7653	.6744E-01	.2656E-02	41.35	36.72
39.34	1.317	7645	.4443E-01	.1745E-02	41.54	37.42
41.66	1.601	7745	.9873E-01	.3868E-02	42.92	38.97
42.41	1.674	7729	.1127E-01	.4417E-02	43.78	39.84
44.75	1.722	7739	.2204E-01	.8734E-02	44.71	40.98
45.44	1.795	7747	.2232E-01	.8744E-02	45.77	41.64
47.15	1.856	7734	.3915E-01	.1541E-01	46.72	42.52
49.71	1.718	7759				

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TABLE D2-16

SPECIMEN NUMBER: 129-212					
SPECIMEN ORIENTATION: LONGITUDINAL					
CONSTRAINT: STRESS					
TEST TEMPERATURE: 212 F					
SPECIMEN THICKNESS: 3.58 MM (0.141 IN)					
MAXIMUM STRESS: 125.4 KPA (32.7 KSI)					
FREQUENCY: 37.200 CYCLES					
CYCLES TO FAILURE: 63.16 KPA SORT(M) 57.42 KSI SORT(M)					
KIMAX: 2 CYCLES PRIOR TO FAILURE					
CRACK LENGTH MM IN	CYCLES	DELTA(A)/DELTA(N) MM/CYCLE	IN/CYCLE	DELTA(Stress Intensity) KPA SORT(M)	KSI SORT(M)
3.86	157	.0072E-02	.2375E-03	23.47	21.36
3.98	157	.0094E-02	.2143E-03	24.54	22.46
4.46	176	.0146E-01	.5529E-03	26.38	24.01
4.13	204	.0207E-01	.7901E-03	27.57	25.37
5.58	220	.0146E-01	.7261E-03	28.97	26.32
6.11	236	.0224E-01	.8024E-03	29.92	27.23
6.39	251	.0339E-01	.1313E-02	31.13	28.33
7.12	276	.0311E-01	.1221E-02	32.26	29.37
7.39	291	.0546E-01	.2229E-02	33.57	30.55
8.19	322	.0527E-01	.2176E-02	35.68	32.47
9.03	378	.0534E-01	.2575E-02	37.54	34.16
10.03	390	.0932E-01	.3671E-02	39.40	35.31
11.72	421	.0801E-01	.3150E-02	40.37	36.47
11.42	450	.1314E-01	.5151E-02	41.20	37.48
11.99	470	.1089E-01	.7437E-02	42.31	39.52
12.72	521	.3156E-01	.1213E-01	43.77	39.43
13.47	536	.3407E-01	.1361E-01	45.57	41.56
14.44	541	.4534E-01	.1785E-01	48.20	43.86
14.41	651	.3666E-01	.1443E-01	50.96	50.71
24.13	350				

TABLE D2-17

SPECIMEN NUMBER: 129-212					
SPECIMEN ORIENTATION: LONGITUDINAL					
CONSTRAINT: STRESS					
TEST TEMPERATURE: 212 F					
SPECIMEN THICKNESS: 3.74 MM (0.147 IN)					
MAXIMUM STRESS: 74.8 KPA (19.8 KSI)					
FREQUENCY: 37.200 CYCLES					
CYCLES TO FAILURE: GRIP FAILURE					
CRACK LENGTH MM IN	CYCLES	DELTA(A)/DELTA(N) MM/CYCLE	IN/CYCLE	DELTA(Stress Intensity) KPA SORT(M)	KSI SORT(M)
7.78	336	.0223E-04	.2856E-05	11.27	10.26
8.32	338	.0333E-04	.1589E-05	11.63	10.50
8.91	347	.0523E-03	.5945E-05	12.07	10.99
9.68	380	.0224E-03	.8894E-05	12.75	11.40
11.90	429	.0257E-03	.4949E-05	13.34	12.14
11.58	456	.0197E-03	.4713E-05	13.78	12.46
12.11	477	.0317E-03	.1424E-04	14.23	12.95
13.42	528				

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TABLE D2-18

SPECIMEN DATA			TEST DATA			
SPECIMEN NO. 1000			DATE: 10-1-74			
SPECIMEN TYPE: T			TEST TYPE: F			
SPECIMEN ORIENTATION: 1			TEST TEMPERATURE: 70 F			
TEST TYPE: F			SPECIMEN THICKNESS: 0.125 IN			
SPECIMEN THICKNESS: 0.125 IN			PUMP: 1000 PSI			
PUMP: 1000 PSI			FREQUENCY: 1000 CPS			
CYCLES TO FAILURE: 1			50.50 MPa (7290 PSI) 46.00 MPa (6660 PSI)			
CRACK LENGTH	IN	CYCLES	DELTA (K)/DELTA (M)	DELTA (STRESS INTENSITY)	DELTA (STRESS INTENSITY)	DELTA (STRESS INTENSITY)
0.14	0.242	1	0.7140E-03	0.2830E-04	16.34	16.91
7.29	0.217	1037	0.6755E-03	0.2654E-04	17.60	16.82
8.27	0.221	2957	0.1069E-02	0.4207E-04	18.54	16.87
8.47	0.253	3676	0.1463E-02	0.5761E-04	19.24	17.51
8.51	0.374	4646	0.1287E-02	0.5051E-04	19.78	18.00
17.12	0.394	4640	0.1775E-02	0.6992E-04	20.38	18.54
17.19	0.421	4819	0.1778E-02	0.6803E-04	21.34	19.15
11.17	0.447	5212	0.2304E-02	0.9394E-04	21.66	19.71
17.17	0.477	5676	0.2523E-02	0.1191E-03	22.31	20.31
17.77	0.503	5739	0.3064E-02	0.1364E-03	22.89	20.83
17.27	0.522	5892	0.4080E-02	0.1863E-03	23.41	21.30
13.97	0.549	6125	0.4845E-02	0.1029E-03	23.91	21.76
14.44	0.588	6133	0.6124E-02	0.2491E-03	24.42	22.22
15.11	0.575	6240	0.4423E-02	0.1741E-03	24.92	22.60
15.33	0.615	6356	0.7938E-02	0.2966E-03	25.45	23.16
15.41	0.646	6660	0.6406E-02	0.2522E-03	26.06	23.72
17.14	0.675	6774	0.1411E-01	0.5584E-03	26.71	24.30
18.11	0.710	6837	0.1564E-01	0.6164E-03	27.42	24.96
18.08	0.747	6890	0.1239E-01	0.4875E-03	28.37	25.55
19.73	0.777	6755	0.1602E-01	0.6388E-03	29.94	26.34
21.71	0.839	6857	0.2411E-01	0.9493E-03	30.12	27.41
22.99	0.925	6926	0.2764E-01	0.1090E-02	31.03	28.42
24.43	0.952	6979	0.5642E-01	0.2221E-02	32.42	29.50
25.41	1.040	7016				
27.74	1.192	7042	0.4701E-01	0.1492E-02	33.54	30.52
28.46	1.136	7052	0.1106E+00	0.4355E-02	34.36	31.27
30.20	1.195	7066	0.9501E-01	0.3764E-02	35.17	32.00
30.39	1.214	7071	0.7999E-01	0.2990E-02	35.73	32.51
F 31.75	1.250	7094	0.8007E-01	0.3546E-02	36.23	32.97
F 34.42	1.355	7090	0.1770E+00	0.7000E-02	37.48	34.09
F 36.19	1.425	7159	0.1770E+00	0.7000E-02	38.07	35.37
F 39.23	1.525	7114	0.4364E+00	0.1600E-01	40.87	36.46
F 40.26	1.545	7110	0.5000E+00	0.2000E-01	41.34	37.62
F 42.74	1.665	7128	0.2316E+01	0.4000E-01	42.60	38.77
F 44.17	1.735	7121	0.1770E+01	0.7000E-01	43.70	39.84
F 47.50	1.870	7122	0.3429E+01	0.1300E+00	45.39	41.31
F 50.24	1.970	7123	0.2560E+01	0.1000E+00	47.29	43.00

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TABLE D2-19

SPECIMEN NUMBER: 125-376
ALLOY TYPE: 2124-T851
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINT: STIFFENED
TEST ENVIRONMENT: ROOM
TEST TEMPERATURE: 300 K
SPECIMEN THICKNESS: 3.23 MM (0.127 IN)
MAXIMUM STRESS: 114.6 MPA (16.7 KSI)
FREQUENCY: 288 KHZ
CYCLES TO FAILURE: 7491 CYCLES
K(MAX): 93 CYCLES PRIOR TO FAILURE: 31.78 MPA SORTIME: 33.46 KSI SORTIME

CRACK LENGTH MM IN		CYCLES	DELTA(SI)/DELTA(IN) MM/CYCLE IN/CYCLE	DELTA(STRESS INTENSIVITY) MPA SORTIME KSI SORTIME		
3.51	.217	1	.4183E-03	.1647E-04	15.47	14.15
6.42	.253	2147	.4709E-03	.2482E-04	16.66	15.07
7.61	.298	3591	.1371E-02	.4216E-04	17.63	16.04
8.23	.324	4638	.1369E-02	.5297E-04	18.78	17.19
9.19	.369	5311	.1904E-02	.7583E-04	19.78	18.10
10.14	.399	5878	.1364E-02	.7734E-04	21.62	18.77
11.16	.435	6158	.3427E-02	.1628E-03	21.38	19.46
11.71	.461	6348	.4455E-02	.1754E-03	22.39	20.11
12.57	.495	6541	.5544E-02	.2183E-03	23.01	20.96
13.72	.541	6749	.6567E-02	.2426E-03	23.86	21.72
14.52	.572	6869	.8133E-02	.3163E-03	24.65	22.43
14.56	.613	6949	.1221E-01	.4411E-03	25.57	23.73
15.15	.666	7147	.1411E-01	.5552E-03	26.51	24.12
15.11	.709	7147	.2216E-01	.8724E-03	27.46	24.49
15.09	.752	7232	.2548E-01	.1033E-02	28.56	25.83
20.75	.817	7237	.3304E-01	.1301E-02	29.08	27.17
22.79	.897	7359	.4564E-01	.1799E-02	31.25	28.44
24.67	.971	7411				

TABLE D2-20

SPECIMEN NUMBER: 125-511
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINT: STIFFENED
TEST ENVIRONMENT: ROOM
TEST TEMPERATURE: 300 K
SPECIMEN THICKNESS: 3.15 MM (0.124 IN)
MAXIMUM STRESS: 102.6 MPA (14.8 KSI)
FREQUENCY: 288 KHZ
CYCLES TO FAILURE: 192 CYCLES
K(MAX): 7 CYCLES PRIOR TO FAILURE: 41.99 MPA SORTIME: 34.22 KSI SORTIME

CRACK LENGTH MM IN		CYCLES	DELTA(SI)/DELTA(IN) MM/CYCLE IN/CYCLE	DELTA(STRESS INTENSIVITY) MPA SORTIME KSI SORTIME		
3.42	.17	1	.4123E-02	.1594E-03	21.53	19.59
4.47	.176	192	.1202E-01	.4734E-03	23.74	21.69
5.07	.220	256	.2370E-01	.8151E-03	26.44	24.88
6.70	.272	319	.2749E-01	.1099E-02	28.55	26.02
7.48	.312	347	.3441E-01	.1355E-02	30.97	27.37
8.44	.332	366	.4809E-01	.3468E-02	31.66	28.81
9.41	.371	380	.3142E+00	.1237E-01	34.64	31.52
11.77	.465	398	.1073E+01	.4247E-01	34.30	34.86
14.18	.554	393				

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TABLE D2-21

SPECIMEN NUMBER						
SPECIMEN CONDITION						
TEST EQUIPMENT						
SPECIMEN TYPE						
MAXIMUM STRESS						
CYCLES TO FAILURE						
4 CYCLES PRIOR TO FAILURE						
59.86 MPA SORTING; 54.47 MPA SORTING						
CRACK LENGTH	IN	CYCLES	DELTA(A)/DELTA(B)	DELTA(C)/DELTA(D)	DELTA(E)/DELTA(F)	DELTA(G)/DELTA(H)
11.94	.676	15877	.4352E-04	.1713E-05	7.61	6.75
12.64	.697	15877	.4022E-04	.1938E-05	7.63	6.98
13.40	.528	31512	.7591E-04	.3146E-05	7.83	7.13
13.96	.553	38473	.7849E-04	.3145E-05	8.02	7.38
14.72	.580	48011	.1314E-03	.5173E-05	8.25	7.51
15.42	.615	54815	.1119E-03	.4813E-05	8.44	7.72
16.42	.646	62664	.9468E-04	.3725E-05	8.72	7.93
17.32	.682	72135	.1667E-03	.6563E-05	8.98	8.17
18.40	.725	78192	.1715E-03	.6751E-05	9.18	8.36
18.44	.743	51462	.1688E-03	.6648E-05	9.35	8.51
19.77	.778	46712	.1244E-03	.1279E-04	9.70	8.82
21.64	.852	32671	.2170E-03	.9329E-05	10.14	9.24
23.53	.927	157478	.4156E-03	.1636E-04	10.53	9.58
24.88	.976	103729	.6190E-03	.2884E-04	10.85	9.87
26.28	1.035	176495	.9417E-03	.2133E-04	11.16	10.15
27.60	1.047	108937	.5901E-03	.2323E-04	11.44	10.41
28.47	1.137	111059	.9329E-03	.3555E-04	11.74	10.68
31.27	1.192	112638	.8711E-03	.3438E-04	12.03	10.95
31.57	1.23	114199	.1062E-02	.4186E-04	12.33	11.22
33.75	1.301	115698	.1139E-02	.4483E-04	12.62	11.49
34.91	1.351	116481	.1445E-02	.5698E-04	12.93	11.77
36.32	1.418	117783	.1245E-02	.7265E-04	13.26	12.07
37.43	1.474	118549	.1344E-02	.7262E-04	13.59	12.37
39.15	1.541	119482				
40.71	1.613	120134	.2180E-02	.8582E-04	13.91	12.68
42.61	1.678	120941	.2655E-02	.1006E-03	14.29	13.08
44.17	1.735	121553	.2378E-02	.9354E-04	14.63	13.32
45.41	1.813	122140	.2462E-02	.1166E-03	14.94	13.62
47.11	1.855	122542	.3248E-02	.1279E-03	15.28	13.98
48.19	1.924	122946	.3554E-02	.1872E-03	15.60	14.15
50.11	1.994	123246	.3953E-02	.1556E-03	15.90	14.47
51.46	2.134	123636	.4537E-02	.1794E-03	16.10	14.73
51.19	2.114	123499	.4241E-02	.1878E-03	16.52	15.04
54.74	2.118	124088	.5147E-02	.2024E-03	16.48	15.34
56.17	2.214	124145	.5354E-02	.2173E-03	17.11	15.62
47.45	2.211	124794	.5174E-02	.2139E-03	17.49	15.88
59.47	2.316	124877	.6573E-02	.2567E-03	17.72	16.12
61.4	2.313	125774	.6641E-02	.2714E-03	18.78	16.44
61.49	2.417	126131	.7481E-02	.2634E-03	18.43	16.77
61.46	2.511	126467	.8347E-02	.3294E-03	18.74	17.09
61.41	2.513	126471	.9345E-02	.3195E-03	19.15	17.43
61.28	2.649	126517	.1114E-01	.4385E-03	19.47	17.81
61.77	2.714	126161	.1114E-01	.4607E-03	20.00	18.28
71.36	2.771	126311	.1114E-01	.4401E-03	20.37	18.54
72.77	2.945	126412	.2257E-01	.6864E-03	20.47	18.99
71.76	2.915	126511	.1114E-01	.4000E-03	21.17	19.38
71.42	2.915	126413	.7127E-01	.8000E-03	21.59	19.74
77.78	3.070	126713	.1727E-01	.6880E-03	22.74	20.24
91.72	3.171	126960	.2132E-01	.8000E-03	22.58	20.42
11.18	3.271	126961	.2561E-01	.1640E-02	23.62	21.58
16.47	3.411	127045	.4386E-01	.1724E-02	24.57	22.36
31.47	3.641	127112	.9857E-01	.1881E-02	26.77	23.66
51.45	3.915	127142	.2159E-01	.8580E-02	28.60	26.83

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TABLE D2-22

SPECIMEN NUMBER: 125-1152
SPECIMEN ORIENTATION: 125-1152
CONSTRAINTS: LONGITUDINAL
TEST TEMPERATURE: 311°F
SPECIMEN THICKNESS: 3.21 MM (0.126 IN)
MAXIMUM STRESS: 118.4 MPA (17.2 KSI)
FREQUENCY: 2740 CYCLES
CYCLES TO FAILURE: 71.33 MPA SORTING 84.92 KSI SORTING
(MIN) 1 CYCLES PRIOR TO FAILURE

CRACK LENGTH MM	IN	CYCLES	DELTA(S) / DELTA(IN) MM/CYCLE	IN/CYCLE	DELTA(STRESS INTENSITY) MPA SORTING	KSI SORTING
7.64	.301	1	.1458E-03	.5741E-05	9.34	8.58
8.24	.324	5122	.2320E-03	.9133E-05	9.91	9.93
9.13	.359	8045	.2771E-03	.1091E-04	10.16	9.25
9.41	.373	10221	.4375E-03	.1632E-04	10.49	9.56
10.73	.427	12315	.6797E-03	.2676E-04	11.91	9.93
11.78	.466	13433	.8124E-03	.3270E-04	11.19	10.36
12.22	.481	14826	.7444E-03	.2931E-04	11.92	10.75
12.84	.505	15631	.1102E-02	.4337E-04	12.10	11.01
13.42	.528	16178	.1128E-02	.4434E-04	12.19	11.27
14.9	.586	16771	.1115E-02	.4391E-04	12.75	11.55
16.77	.662	17395	.1984E-02	.6630E-04	13.03	11.66
15.62	.614	17910	.1715E-02	.6752E-04	13.79	12.17
16.36	.643	18361	.1818E-02	.7158E-04	13.96	12.43
16.93	.666	18653	.3422E-02	.1347E-03	13.94	12.68
17.66	.699	18876	.2674E-02	.1053E-03	14.23	12.95
18.36	.722	19131	.2655E-02	.1124E-03	14.51	13.20
19.05	.751	19381	.3308E-02	.1302E-03	14.91	13.57
20.35	.801	19773	.4477E-02	.1763E-03	15.42	14.34
21.54	.853	20173	.4128E-02	.1625E-03	15.92	14.69
22.47	.884	20392	.6151E-02	.2421E-03	16.45	14.97
24.44	.964	20633	.6536E-02	.2513E-03	16.96	15.42
25.72	1.012	20912	.6572E-02	.2627E-03	17.42	15.85
27.12	1.068	21025	.8952E-02	.3524E-03	17.13	15.32
28.61	1.126	21130	.9921E-02	.3827E-03	17.51	15.95
30.51	1.201	21472	.9521E-02	.3744E-03	17.14	15.34
31.74	1.251	21511	.1187E-01	.4674E-03	17.55	15.79
33.42	1.316	21674	.1241E-01	.4845E-03	20.09	18.27
34.93	1.374	21793	.1793E-01	.7094E-03	20.62	18.77
36.71	1.445	21844	.8594E-02	.3384E-03	21.16	19.17
37.56	1.479	21911	.1634E-01	.6453E-03	21.52	19.68
39.44	1.555	22111	.1449E-01	.5861E-03	22.34	20.16
40.71	1.604	22134	.1372E-01	.5776E-03	22.45	20.43
41.99	1.653	22254	.2721E-01	.1071E-02	22.44	20.13
43.41	1.709	22311	.1895E-01	.7461E-03	23.11	21.21
44.67	1.756	22373	.3532E-01	.1391E-02	23.75	21.51
46.9	1.844	22415	.3371E-01	.1299E-02	24.14	22.11
47.28	1.856	22434	.3123E-01	.1204E-02	24.69	22.46
49.11	1.933	22519	.4504E-01	.1774E-02	25.17	22.96
50.24	1.978	22514	.4181E-01	.1644E-02	25.62	23.31
51.82	2.040	22572	.4671E-01	.1839E-02	26.09	23.74
F 53.19	2.104	22644	.8255E-01	.3351E-02	26.58	24.19
F 54.74	2.156	22619	.4143E-01	.1617E-02	27.26	24.81
F 57.15	2.250	22649	.6194E-01	.2421E-02	28.27	25.66
F 58.27	2.307	22639	.1101E-01	.4333E-02	28.72	26.41
F 61.45	2.415	22714	.2544E-01	.1001E-01	29.76	27.19
F 64.39	2.535	22724	.3364E-01	.1363E-01	30.91	28.13
F 67.16	2.640	22712	.4424E-01	.1941E-01	31.45	28.98
F 68.19	2.705	22717	.7366E-01	.2911E-01	33.23	30.16
F 71.46	2.813	22743	.7302E-01	.2875E-01	34.36	31.27
F 74.14	2.915	22745	.4255E-01	.1621E-01	35.11	32.14
F 78.23	3.080	22745				

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TABLE D2-23

SPECTRA NUMBER										125-PL10
SPECIMEN DESIGNATION										2-2-1781
CONSTRAINT										LONGITUDINAL
TEST TEMPERATURE										STRESS
SPECTRA NUMBER										125-PL10
MAXIMUM STRESS										7.25 MM (1.25 IN)
FREQUENCY										225.6 MPA (32.6 KSI)
CYCLES TO FAILURE										7.25 MM (1.25 IN)
KIMAX										7.25 MM (1.25 IN)
1 CYCLES PRIOR TO FAILURE										63.02 MPA SORTIN (9.18 KSI SORTIN)
CRACK LENGTH										DELTA STRESS INTENSITY
MM	IN	CYCLES	MPA/CYCLE	IN/CYCLE	MPA SORTIN	KSI SORTIN				
0.01	.0004	1	.3875E-02	.1447E-03	14.40	13.18				
5.67	.223	236	.3481E-02	.1449E-03	15.61	14.21				
6.51	.256	463	.7222E-02	.2843E-03	16.81	15.03				
7.11	.281	546	.5406E-02	.2236E-03	17.19	14.46				
7.44	.293	637	.7101E-02	.2827E-03	18.92	16.40				
8.57	.337	767	.1127E-01	.4437E-03	19.37	17.31				
9.46	.372	844	.1192E-01	.4614E-03	19.93	18.06				
11.12	.439	979	.1324E-01	.5213E-03	20.46	18.40				
11.12	.438	984	.1307E-01	.5093E-03	21.42	19.49				
11.49	.460	1022	.2246E-01	.8841E-03	22.12	20.13				
12.61	.496	1043	.3489E-01	.1374E-02	23.34	21.24				
14.39	.567	1114	.5122E-01	.1977E-02	24.90	22.37				
19.43	.761	1136	.1410E+00	.4953E-02	26.99	24.20				
19.32	.761	1163	.1835E+01	.3271E+00	28.05	25.49				
21.32	.840	1175	.1277E+01	.7083E+01	29.68	26.82				
22.13	.870	1176	.2343E+01	.1880E+01	31.92	28.23				
24.64	.978	1177								

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TABLE D2-24

SPECIMEN NUMBER				TEST EQUIPMENT			
SPECIMEN ORIENTATION				STIFFNESS			
CONSTRAINTS				FREQUENCY			
TEST EQUIPMENT				FREQUENCY			
SPECIMEN VIBRATION				FREQUENCY			
MAXIMUM STRESS				FREQUENCY			
Cycles to Failure				FREQUENCY			
KINAXI				FREQUENCY			
23 CYCLES PRIOR TO FAILURE				FREQUENCY			
41.95 MPa SORTING				FREQUENCY			
39.18 KSI SORTING				FREQUENCY			
CRACK LENGTH				DELTA(I)/DELTA(II)			
IN				IN/CYCLE			
CYCLES				DELTA(III)/DELTA(IV)			
MM				MPa SORTING			
IN				KSI SORTING			
11.26				7.19			
12.31				6.41			
13.16				7.01			
13.41				7.16			
14.27				7.31			
14.37				7.70			
15.41				7.71			
16.04				7.88			
17.23				8.16			
18.44				8.52			
21.43				9.45			
21.44				9.21			
21.43				9.55			
21.44				9.44			
26.19				10.12			
27.19				10.12			
27.45				10.55			
32.45				10.98			
34.16				11.30			
34.75				11.63			
37.5				11.40			
37.45				12.19			
44.47				12.15			
47.41				12.48			
47.64				13.14			
47.64				13.49			
47.64				14.11			
51.4				14.37			
51.4				14.61			
51.4				14.96			
53.14				15.14			
53.14				15.63			
53.14				15.96			
53.14				16.15			
53.14				16.55			
53.14				16.96			
53.14				17.40			
53.14				17.78			
53.14				18.22			
53.14				18.50			

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TABLE D2-25

SPECIMEN NUMBER: 125-4711						
SPEICIMEN ORIENTATION: 125-T861						
CONSTRAINTS: 125-T861						
ENVIRONMENT: 125-T861						
TEST TEMPERATURE: 125-T861						
SPECIMEN THICKNESS: 125-T861						
MAXIMUM STRESS: 125-T861						
FREQUENCY: 125-T861						
CYCLES TO FAILURE: 125-T861						
MINAMI 1 CYCLES PRIOR TO FAILURE: 125-T861						
40.48 MPA SORTIME: 125-T861						
CRACK LENGTH	IN	CYCLES	DELTA (A)/DELTA (B)	DELTA (A)/DELTA (B)	DELTA (A)/DELTA (B)	DELTA (A)/DELTA (B)
MM			IN/CYCLE	IN/CYCLE	MPA SORTIME	MPA SORTIME
7.94	.313	1	.4739E-03	.1854E-04	9.86	9.77
8.42	.367	1462	.4599E-03	.1968E-04	10.37	9.19
9.56	.374	3343	.7154E-03	.2617E-04	10.51	9.56
10.34	.407	4433	.8584E-03	.3419E-04	10.71	9.93
11.18	.436	5290	.1214E-02	.4779E-04	11.30	10.28
11.88	.468	5947	.1298E-02	.5109E-04	11.56	10.61
12.53	.493	6451	.1317E-02	.5184E-04	11.94	10.90
13.71	.528	6956	.1304E-02	.1197E-03	12.32	11.21
14.37	.551	7225	.2653E-02	.1644E-03	12.70	11.55
14.87	.585	7552	.4252E-02	.1874E-03	13.17	11.95
15.34	.628	7815	.3512E-02	.1543E-03	13.54	12.36
16.97	.658	8167	.5370E-02	.2114E-03	13.98	12.72
17.44	.722	9229	.5743E-02	.2261E-03	14.39	13.10
18.99	.748	8430	.5865E-02	.2309E-03	14.47	13.53
23.20	.795	8637	.1395E-01	.4310E-03	15.14	14.08
21.62	.851	8766	.1214E-01	.4778E-03	16.32	14.58
23.58	.928	8828	.1445E-01	.5690E-03	16.41	15.12
26.80	.976	9012	.2214E-01	.9110E-03	17.10	15.65
26.79	1.355	9098	.3429E-01	.1350E-02	17.72	16.14
29.12	1.127	9137	.3195E-01	.1337E-02	18.73	16.68
29.55	1.177	9189	.3827E-01	.1425E-02	18.94	17.24
31.70	1.248	9219	.7581E-01	.3142E-02	19.64	17.91
36.75	1.349	9271	.1735E+00	.6812E-02	22.59	18.74
37.14	1.404	9284				
F	34.55	1.535	.8971E+00	.3533E-01	21.14	19.45
F	41.15	1.670	.7197E+00	.2833E-01	22.32	20.04
F	42.42	1.671	.6150E+00	.2500E-01	22.54	20.55
F	45.59	1.735	.1587E+01	.6253E-01	23.31	21.21
F	46.46	1.805	.1270E+01	.5002E-01	24.77	21.87

TABLE D2-26

SPECIMEN NUMBER: 125-573						
SPEICIMEN ORIENTATION: 125-T861						
CONSTRAINTS: 125-T861						
ENVIRONMENT: 125-T861						
TEST TEMPERATURE: 125-T861						
SPECIMEN THICKNESS: 125-T861						
MAXIMUM STRESS: 125-T861						
FREQUENCY: 125-T861						
CYCLES TO FAILURE: 125-T861						
MINAMI 1 CYCLES PRIOR TO FAILURE: 125-T861						
43.14 MPA SORTIME: 125-T861						
CRACK LENGTH	IN	CYCLES	DELTA (A)/DELTA (B)	DELTA (A)/DELTA (B)	DELTA (A)/DELTA (B)	DELTA (A)/DELTA (B)
MM			IN/CYCLE	IN/CYCLE	MPA SORTIME	MPA SORTIME
4.75	.159	1	.2487E-02	.9110E-04	11.45	11.84
4.87	.147	747	.2314E-02	.9044E-04	12.35	11.79
4.91	.204	749	.5321E-02	.1577E-03	13.45	12.81
5.55	.259	819	.6145E-02	.2474E-03	14.71	13.38
7.17	.291	1071	.6297E-02	.1104E-03	15.40	14.49
9.34	.352	1174	.1167E-01	.4597E-03	17.74	17.41
9.73	.443	1241	.3197E-01	.1214E-02	17.93	18.23
11.00	.421	1277	.4104E-01	.3101E-02	18.77	17.44
11.41	.487	1290	.6407E-01	.2440E-02	19.43	17.78
11.87	.547	1298	.2740E-01	.1460E-02	20.73	17.67
12.07	.594	1300	.5711E-01	.2701E-02	21.45	18.45
14.00	.647	1300				

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TABLE D2-27

SPECIMEN NUMBER						
SPECIMEN CRYSTALLOGRAPHIC ORIENTATION						
TEST TEMPERATURE						
SPECIMEN SURFACE FINISH						
MAXIMUM STRESS						
FREQUENCY						
CYCLES TO FAILURE						
KIMURA 1 CYCLES PRIOR TO FAILURE						
49.81 MPa SORTING 45.33 KSI SORTING						
CRACK LENGTH	IN	CYCLES	DELTA STRESS/DELTA IN	IN/CYCLE	DELTA STRESS	INTENSITY
MM			MPa/CYCLE		MPa SORTING	KSI SORTING
9.25	.365	7143	.9091E-04	.3094E-05	11.90	10.90
10.25	.396	13847	.1165E-03	.4505E-05	12.47	11.35
10.92	.470	19044	.1254E-03	.6513E-05	13.00	11.03
11.55	.450	23269	.1708E-03	.7640E-05	13.55	12.29
12.75	.532	20090	.2237E-03	.8007E-05	14.05	12.70
13.57	.514	31895	.2192E-03	.8624E-05	14.59	13.27
14.10	.555	31674	.3081E-03	.1213E-04	14.96	13.62
14.74	.586	35342	.3540E-03	.1394E-04	15.70	13.91
15.52	.611	37322	.3591E-03	.1572E-04	15.66	14.25
16.78	.641	39777	.3917E-03	.1542E-04	16.07	14.62
17.10	.672	40903	.4889E-03	.1925E-04	16.47	14.99
17.44	.753	42331	.5372E-03	.2115E-04	16.56	15.35
18.46	.716	45639	.6195E-03	.2439E-04	17.25	15.70
19.45	.766	44461	.9656E-03	.3082E-04	17.64	16.06
20.58	.914	45958	.8195E-03	.3221E-04	18.12	16.49
22.27	.877	47552	.1302E-02	.3946E-04	18.78	17.09
23.49	.933	48706	.1141E-02	.4494E-04	19.47	17.72
25.51	1.124	10155	.1334E-02	.5256E-04	20.19	18.37
26.04	1.158	52624	.1787E-02	.7036E-04	20.98	19.00
28.43	1.127	51716	.2151E-02	.8488E-04	21.54	19.60
30.44	1.214	52933	.2537E-02	.9987E-04	22.31	20.31
32.36	1.273	53651	.3214E-02	.1266E-03	23.04	21.00
34.19	1.346	53645	.3746E-02	.1475E-03	23.81	21.67
36.32	1.414	54611	.4584E-02	.1805E-03	24.61	22.40
38.31	1.378	54634	.4705E-02	.1852E-03	25.43	23.14
39.79	1.506	54731	.4663E-02	.1955E-03	26.12	23.77
41.78	1.641	55612	.6992E-02	.2753E-03	26.78	24.37
43.77	1.752	55170	.8174E-02	.3218E-03	27.45	24.99
44.76	1.751	55651	.9311E-02	.3666E-03	28.74	25.93
46.77	1.872	54539	.9917E-02	.3862E-03	28.68	26.00
47.91	1.944	54657	.1113E-01	.4382E-03	29.28	26.55
48.93	1.946	55765	.1358E-01	.5331E-03	29.90	27.21
50.97	2.037	55846	.1342E-01	.5291E-03	30.51	27.77
52.93	2.050	55096	.1353E-01	.5325E-03	31.09	28.29
54.16	2.112	56037	.1588E-01	.6638E-03	31.73	28.80
55.47	2.112	56196	.1621E-01	.6302E-03	32.41	29.49
57.74	2.274	56278	.2264E-01	.8075E-03	33.16	30.16
59.17	2.311	56276	.2303E-01	.9058E-03	34.03	30.97
61.77	2.474	56440	.2419E-01	.9573E-03	34.93	31.70
64.77	2.540	56633	.3172E-01	.1249E-02	35.92	32.58
66.74	2.602	56647	.3148E-01	.1230E-02	36.78	33.47
68.36	2.711	56647	.3712E-01	.1370E-02	37.86	34.45
70.74	2.935	56773	.4574E-01	.1722E-02	38.63	35.97
77.74	3.035	56843	.5447E-01	.2143E-02	41.40	37.68
80.74	3.156	56843	.7537E-01	.3125E-02	43.18	39.38
81.77	3.211	56831	.1276E+02	.5003E-02	44.36	40.37
92.74	3.265	56933	.1397E+02	.5508E-02	45.80	41.84
97.74	3.311	56933	.1272E+02	.5000E-02	45.73	41.62
98.71	3.335	56912	.4445E+02	.1750E-01	46.24	42.88
99.11	3.341	56913	.1197E+01	.5500E-01	46.90	42.68

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TABLE D2-28

SPECIMEN NUMBER:			U125-1113			
SPECIMEN ORIENTATION:			LONGITUDINAL			
CONSTRAINT:			UNSTRESS			
TEST TEMPERATURE:			301°K			
SPECIMEN FREQUENCY:			200 Hz			
MAXIMUM STRESS:			225.5 MPa (32.7 KSI)			
CYCLES TO FAILURE:			2379 CYCLES			
K(MAX) 26 CYCLES PRIOR TO FAILURE:			39.64 MPa SORTING (36.74 KSI SORTING)			
CRACK LENGTH	IN	CYCLES	DELTA(I)/DELTA(II)	DELTA(II)/DELTA(III)	DELTA(III)/DELTA(IV)	DELTA(IV)/DELTA(V)
MM			MM/CYCLE	IN/CYCLE	MPa SORTING	KSI SORTING
6.85	.274	1	.1977E-02	.7784E-04	16.90	19.38
7.39	.291	256	.1814E-02	.7159E-04	17.52	19.96
7.94	.313	557	.4239E-02	.1667E-03	18.31	16.67
8.81	.347	763	.1836E-02	.7224E-04	19.39	17.36
9.35	.368	1057	.3538E-02	.1358E-03	19.53	17.86
9.96	.398	1196	.4762E-02	.1874E-03	19.21	16.39
10.90	.414	1321	.3584E-02	.1537E-03	20.87	14.99
11.19	.441	1497	.7771E-02	.386CE-03	21.60	19.66
12.04	.474	1696	.7426E-02	.2924E-03	22.34	20.35
12.92	.505	1711	.1210E-01	.4796E-03	23.22	21.13
13.95	.549	1834	.1838E-02	.3873E-03	24.35	21.89
14.79	.592	1883	.1243E-01	.4893E-03	24.74	22.92
15.62	.614	1953	.1853E-01	.6507E-03	25.57	23.27
16.72	.658	2021	.2388E-01	.9488E-03	26.44	24.00
17.90	.711	2056	.1894E-01	.7463E-03	27.11	24.74
18.57	.731	2197	.3334E-01	.1311E-02	27.79	25.29
19.37	.763	2131	.2648E-01	.1262E-02	28.67	25.98
20.37	.802	2168	.3503E-01	.1537E-02	29.77	26.64
21.54	.848	2198	.3518E-01	.1542E-02	30.70	27.49
22.35	.914	2234	.5584E-01	.2198E-02	31.35	28.93
24.98	.976	2267	.9423E-01	.2134E-02	32.52	29.59
26.71	1.036	2295	.8134E-01	.3202E-02	33.63	30.61
29.10	1.116	2317	.1894E-01	.4324E-02	34.35	31.71
29.77	1.146	2334	.1294E-01	.4938E-02	35.99	32.75
31.60	1.244	2347	.2234E-01	.8794E-02	37.34	33.75
33.39	1.314	2355				

TABLE D2-29

SPECIMEN NUMBER:			U125-1113			
SPECIMEN ORIENTATION:			LONGITUDINAL			
CONSTRAINT:			UNSTRESS			
TEST TEMPERATURE:			301°K			
SPECIMEN FREQUENCY:			200 Hz			
MAXIMUM STRESS:			225.5 MPa (32.7 KSI)			
CYCLES TO FAILURE:			513 CYCLES			
K(MAX) 26 CYCLES PRIOR TO FAILURE:			46.77 MPa SORTING (43.74 KSI SORTING)			
CRACK LENGTH	IN	CYCLES	DELTA(I)/DELTA(II)	DELTA(II)/DELTA(III)	DELTA(III)/DELTA(IV)	DELTA(IV)/DELTA(V)
MM			MM/CYCLE	IN/CYCLE	MPa SORTING	KSI SORTING
3.42	.135	1	.5701E-02	.2244E-03	22.99	28.92
3.91	.154	17	.2461E-02	.1126E-03	24.17	28.08
4.19	.165	196	.7344E-02	.2891E-03	25.12	23.65
4.73	.185	255	.1394E-01	.6121E-03	27.26	24.81
5.63	.221	313	.1215E-01	.4733E-03	28.69	26.30
5.97	.235	343	.2386E-01	.8212E-03	30.01	27.31
6.71	.268	349	.2277E-01	.8944E-03	31.67	28.58
7.15	.281	337	.3312E-01	.1186E-02	32.97	30.71
7.90	.311	432	.5351E-01	.1944E-02	34.50	31.39
8.45	.337	435	.6545E-01	.1711E-02	35.81	32.59
9.16	.361	449	.4104E-01	.1610E-02	37.78	33.74
9.42	.367	445	.6378E-01	.2511E-02	39.27	34.83
11.39	.449	474	.1377E-01	.6214E-02	46.71	37.15
12.44	.490	447				

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SPECIMEN NUMBER:
SPECIMEN ORIENTATION:
CONSTRAINT:
ENVIRONMENT:
TEST TEMPERATURE:
SPECIMEN THICKNESS:
MAXIMUM STRESS:
R-RATIO:
FREQUENCY:
ANGLE TO CAXIAL:

U129-679
2004-1003
YANKEE
UNSTIFFENED
ASBON
703-2-5
3.24 MM (1.18 IN)
74.5 MPa (10.8 KSI)
208 CPM
49723 CYCLES
31.24 KSI (5071 IN)

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TABLE D2-31

SPECIMEN NUMBER				0125-172		
CCTV TYPE				2124-T851		
SPECIMEN ORIENTATION				UNSTIFFENED		
LOADS				2000 LBS		
TEST TEMPERATURE				70 F		
SPECIMEN THICKNESS				1.43 MM (0.056 IN)		
MAXIMUM STRESS				147.0 MPa (21.2 KSI)		
R-RATIO				0.2		
FREQUENCY				280 CPS		
CYCLES TO FAILURE				684 CYCLES		
KINEMATIC CYCLES PRIOR TO FAILURE				34.02 MPa SORTING 34.02 KSI SORTING		
CRACK LENGTH MM	IN	CYCLES	DELTA(IAS)/DELTA(SI) MM/CYCLE	IN/CYCLE	DELTA STRESS INTENSITY MPa (KSI)	DELTA STRESS INTENSITY KSI (MPa)
4.00	0.157	139	.2297E-02	.9022E-04	18.97	19.68
4.10	0.161	442	.3657E-02	.1440E-03	21.91	20.03
4.15	0.163	477	.0655E-02	.3543E-03	22.78	20.73
4.20	0.165	171	.4282E-02	.3261E-03	24.09	21.93
4.25	0.167	171	.2152E-01	.8074E-03	25.42	23.13
4.30	0.169	171	.1607E-01	.6393E-03	26.10	23.76
4.35	0.171	171	.2521E-01	.1100E-02	26.48	24.47
4.40	0.173	171	.2133E-01	.8391E-03	27.70	25.21
4.45	0.175	171	.3197E-01	.1213E-02	28.47	25.91
4.50	0.177	171	.5445E-01	.2144E-02	29.79	27.08
4.55	0.179	171	.9157E-01	.3606E-02	31.17	28.37
4.60	0.181	171	.2324E-02	.9153E-02	32.54	29.65
4.65	0.183	171	.2527E-01	.9950E-02	33.41	30.77
4.70	0.185	171	.5745E-01	.2277E-01	35.14	32.01

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TABLE D2-32

SPECIMEN NUMBERS				DATE-1110		
SPECIMEN CRYSTALLINITY				LOW TEMPERATURE		
TEST TEMPERATURE				UNSTRESSING		
SPECIMEN THICKNESS				3-24 MM (1.181 IN)		
MAXIMUM STRESS				75.2 MPa (10.9 KSI)		
FREQUENCY				200 Hz		
CYCLES TO FAILURE				50.66 MPa (7.34 KSI)		
KIMAX				1 CYCLES PRIOR TO FAILURE		
CRACK LENGTH	CYCLES	DELTA K(I)/DELTA IN	IN/CYCLE	DELTA (STRESS INTENSITY)	DELTA (STRESS INTENSITY)	DELTA (STRESS INTENSITY)
6.96	1270	1.203E-03	1.203E-03	10.74	10.74	10.74
7.91	1296	1.091E-03	1.091E-03	11.23	11.23	11.23
8.20	1323	1.226E-03	1.226E-03	11.43	11.43	11.43
8.53	1340	1.271E-03	1.271E-03	11.86	11.86	11.86
8.46	1372	1.250E-03	1.250E-03	12.95	12.95	12.95
10.11	1403	1.284E-03	1.284E-03	12.97	12.97	12.97
10.78	1424	1.317E-03	1.317E-03	13.16	13.16	13.16
11.17	1445	1.364E-03	1.364E-03	13.76	13.76	13.76
12.10	1477	1.393E-03	1.393E-03	14.13	14.13	14.13
12.63	1497	1.404E-03	1.404E-03	14.49	14.49	14.49
13.12	1518	1.523E-03	1.523E-03	14.92	14.92	14.92
14.17	1538	1.431E-03	1.431E-03	15.27	15.27	15.27
14.63	1569	1.616E-03	1.616E-03	15.85	15.85	15.85
15.21	1599	1.645E-03	1.645E-03	15.90	15.90	15.90
15.91	1626	1.612E-03	1.612E-03	16.29	16.29	16.29
16.73	1639	1.650E-03	1.650E-03	16.64	16.64	16.64
17.33	1661	1.636E-03	1.636E-03	16.93	16.93	16.93
17.46	1676	1.687E-03	1.687E-03	17.22	17.22	17.22
17.95	1697	1.647E-03	1.647E-03	17.56	17.56	17.56
18.48	1728	1.627E-03	1.627E-03	17.96	17.96	17.96
19.13	1757	1.627E-03	1.627E-03	18.37	18.37	18.37
19.77	1778	1.643E-03	1.643E-03	18.97	18.97	18.97
20.47	1802	1.643E-03	1.643E-03	19.50	19.50	19.50
21.47	1842	1.643E-03	1.643E-03	20.09	20.09	20.09
22.16	1862	1.643E-03	1.643E-03	20.65	20.65	20.65
23.75	1891	1.643E-03	1.643E-03	21.21	21.21	21.21
24.12	1915	1.643E-03	1.643E-03	21.77	21.77	21.77
24.30	1935	1.643E-03	1.643E-03	22.33	22.33	22.33
24.72	1952	1.643E-03	1.643E-03	22.89	22.89	22.89
25.17	1977	1.643E-03	1.643E-03	23.45	23.45	23.45
25.67	2002	1.643E-03	1.643E-03	24.01	24.01	24.01
26.17	2027	1.643E-03	1.643E-03	24.57	24.57	24.57
26.67	2052	1.643E-03	1.643E-03	25.13	25.13	25.13
27.17	2077	1.643E-03	1.643E-03	25.69	25.69	25.69
27.67	2102	1.643E-03	1.643E-03	26.25	26.25	26.25
28.17	2127	1.643E-03	1.643E-03	26.81	26.81	26.81
28.67	2152	1.643E-03	1.643E-03	27.37	27.37	27.37
29.17	2177	1.643E-03	1.643E-03	27.93	27.93	27.93
29.67	2202	1.643E-03	1.643E-03	28.49	28.49	28.49
30.17	2227	1.643E-03	1.643E-03	29.05	29.05	29.05
30.67	2252	1.643E-03	1.643E-03	29.61	29.61	29.61
31.17	2277	1.643E-03	1.643E-03	30.17	30.17	30.17
31.67	2302	1.643E-03	1.643E-03	30.73	30.73	30.73
32.17	2327	1.643E-03	1.643E-03	31.29	31.29	31.29
32.67	2352	1.643E-03	1.643E-03	31.85	31.85	31.85
33.17	2377	1.643E-03	1.643E-03	32.41	32.41	32.41
33.67	2402	1.643E-03	1.643E-03	32.97	32.97	32.97
34.17	2427	1.643E-03	1.643E-03	33.53	33.53	33.53
34.67	2452	1.643E-03	1.643E-03	34.09	34.09	34.09
35.17	2477	1.643E-03	1.643E-03	34.65	34.65	34.65
35.67	2502	1.643E-03	1.643E-03	35.21	35.21	35.21
36.17	2527	1.643E-03	1.643E-03	35.77	35.77	35.77
36.67	2552	1.643E-03	1.643E-03	36.33	36.33	36.33
37.17	2577	1.643E-03	1.643E-03	36.89	36.89	36.89
37.67	2602	1.643E-03	1.643E-03	37.45	37.45	37.45
38.17	2627	1.643E-03	1.643E-03	38.01	38.01	38.01
38.67	2652	1.643E-03	1.643E-03	38.57	38.57	38.57
39.17	2677	1.643E-03	1.643E-03	39.13	39.13	39.13
39.67	2702	1.643E-03	1.643E-03	39.69	39.69	39.69
40.17	2727	1.643E-03	1.643E-03	40.25	40.25	40.25
40.67	2752	1.643E-03	1.643E-03	40.81	40.81	40.81
41.17	2777	1.643E-03	1.643E-03	41.37	41.37	41.37
41.67	2802	1.643E-03	1.643E-03	41.93	41.93	41.93
42.17	2827	1.643E-03	1.643E-03	42.49	42.49	42.49
42.67	2852	1.643E-03	1.643E-03	43.05	43.05	43.05
43.17	2877	1.643E-03	1.643E-03	43.61	43.61	43.61
43.67	2902	1.643E-03	1.643E-03	44.17	44.17	44.17
44.17	2927	1.643E-03	1.643E-03	44.73	44.73	44.73
44.67	2952	1.643E-03	1.643E-03	45.29	45.29	45.29

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TABLE D2-33

SPECIMEN NUMBER				UNITS				
SPECIMEN ORIENTATION				LONGITUDINAL				
TEST TEMPERATURE				UNSTRESS				
SPECIMEN TYPE				1.24 MM (1/2 IN)				
MAXIMUM STRESS				118.6 MPa (17.2 KSI)				
CYCLES TO FAILURE				200 Cycles				
(KINAK) 1 CYCLES PRIOR TO FAILURE				67.55 MPa SORT(H); 61.47 KSI SORT(H)				
CRACK LENGTH	IN	CYCLES	MM/CYCLE	DELTA(Stress)	DELTA(Stress)	DELTA(Stress)	DELTA(Stress)	
5.35	.211	1	.3126E-03	.1231E-04	14.91	13.57		
5.77	.227	1354	.5581E-03	.2197E-04	15.61	14.21		
6.42	.253	2519	.1820E-02	.4017E-04	16.44	15.00		
7.16	.292	3246	.1120E-02	.4409E-04	17.35	15.79		
7.99	.318	3809	.9895E-03	.3896E-04	18.17	16.53		
8.60	.338	4639	.1240E-02	.4881E-04	18.92	17.32		
9.28	.365	5157	.1635E-02	.6439E-04	19.65	17.88		
9.99	.393	9588	.2090E-02	.8227E-04	20.40	18.57		
10.76	.424	5963	.2154E-02	.8498E-04	21.09	19.19		
11.39	.448	6251	.2438E-02	.9599E-04	21.79	19.79		
12.15	.479	6863	.3893E-02	.1415E-03	22.50	20.48		
13.31	.512	6403	.4201E-02	.1693E-03	23.15	21.67		
13.60	.535	6941	.3222E-02	.1269E-03	23.66	21.93		
14.16	.558	7111	.3579E-02	.1409E-03	24.24	22.06		
14.5	.584	7335	.6774E-02	.2274E-03	24.98	22.73		
15.12	.627	7507	.6577E-02	.2598E-03	25.73	23.42		
15.79	.651	7636	.4673E-02	.1838E-03	26.32	23.95		
16.39	.685	7764	.9449E-02	.3720E-03	26.47	24.46		
16.19	.714	7848	.4784E-02	.3852E-03	27.60	25.28		
19.50	.769	7043	.4947E-02	.3844E-03	28.60	26.03		
20.40	.811	8107	.1271E-01	.5004E-03	29.54	26.88		
22.05	.858	8221	.1141E-01	.4571E-03	30.44	27.71		
23.11	.910	9312	.1717E-01	.6754E-03	31.34	28.52		
24.67	.954	8339						
26.42	1.014	8464	.1777E-01	.6949E-03	32.74	29.38		
27.16	1.076	8537	.2212E-01	.8710E-03	33.27	30.23		
28.46	1.124	8791	.2101E-01	.8274E-03	34.17	31.04		
F	12.14	1.275	8730	.3571E-01	.1404E-02	35.76	32.54	
F	16.15	1.390	8750	.5334E-01	.2100E-02	37.44	34.47	
F	17.71	1.461	8791	.5399E-01	.2125E-02	38.42	35.06	
F	18.11	1.570	8820	.4677E-01	.1833E-02	40.57	36.87	
F	41.49	1.611	8844	.4144E-01	.3603E-02	41.66	37.92	
F	47.37	1.644	8855	.1314E-00	.4030E-02	44.31	39.14	
F	44.43	1.765	8876	.1361E-00	.5357E-02	44.23	40.25	
F	47.12	1.855	8870	.2374E-00	.8182E-02	45.57	41.43	
F	48.71	1.848	8903	.2744E-00	.1102E-01	47.11	42.87	
F	51.17	2.105	8929	.5385E-00	.2003E-01	47.24	44.83	
F	57.25	2.200	8912	.7537E-00	.1125E-01	51.67	46.93	
F	61.16	2.420	8915	.1270E-01	.5000E-01	53.45	49.00	
F	67.17	2.445	8915	.1143E-01	.4500E-01	55.50	50.50	
F	44.71	2.575	8917	.1904E-01	.7500E-01	56.43	51.44	
F	47.77	2.630	8918	.2921E-01	.1150E-00	54.15	52.96	
F	71.44	2.920	8915	.2731E-01	.2450E-00	61.64	56.10	

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TABLE D2-36

SPECIMEN NUMBER						
SPECTION C						
CONSTRAINT						
TEST ENVIRONMENT						
SPECIMEN TO THICKNESS						
MAXIMUM STRESS						
R-RATIO						
CYCLES TO FAILURE						
K14891 147 CYCLES PRIOR TO FAILURE						
31.83 MPA SORTIME 28.96 KSI SORTIME						
CRACK LENGTH	IN	CYCLES	DELTA(A)/DELTA(S)	IN/CYCLE	DELTA STRESS	INTENSITY
MPA	IN		MPA/CYCLE		PPA SORTIME	KSI SORTIME
5.25	.199	1	.7611E-03	.2990E-04	14.43	13.31
5.67	.223	812	.8107E-03	.3184E-04	15.48	14.81
6.20	.244	1478	.6702E-03	.2638E-04	16.80	14.96
6.61	.260	2144	.9963E-03	.3883E-04	16.66	15.16
7.27	.286	2751	.1356E-02	.4457E-04	17.42	15.88
7.95	.311	3344	.1318E-02	.5183E-04	18.18	16.54
8.61	.339	3891	.2604E-02	.1027E-03	18.99	17.20
9.38	.369	4186	.2129E-02	.8367E-04	19.72	17.95
10.72	.394	4486	.2851E-02	.1122E-03	20.39	18.96
11.71	.422	4727	.3388E-02	.1214E-03	21.88	19.19
11.43	.446	4941	.2860E-02	.1126E-03	21.73	19.78
12.16	.475	5183	.5962E-02	.2388E-03	22.18	20.36
12.83	.535	5312	.4549E-02	.1791E-03	23.00	20.93
13.44	.529	5447	.7763E-02	.3096E-03	23.96	21.47
14.18	.558	4541	.8706E-02	.3425E-03	24.41	22.22
15.34	.634	5675	.9796E-02	.3858E-03	25.31	23.84
16.34	.643	5777	.1433E-01	.5628E-03	26.37	24.88
17.46	.717	4890	.1521E-01	.5998E-03	27.57	25.09
19.46	.794	5946	.2112E-01	.7921E-03	28.70	26.12
20.37	.875	6162	.2597E-01	.1016E-02	29.78	27.08
22.79	.877	6114				

TABLE D2-37

SPECIMEN NUMBER						
SPECTION C						
CONSTRAINT						
TEST ENVIRONMENT						
SPECIMEN TO THICKNESS						
MAXIMUM STRESS						
R-RATIO						
CYCLES TO FAILURE						
K14891 164 CYCLES PRIOR TO FAILURE						
23.76 MPA SORTIME 21.67 KSI SORTIME						
CRACK LENGTH	IN	CYCLES	DELTA(A)/DELTA(S)	IN/CYCLE	DELTA STRESS	INTENSITY
MPA	IN		MPA/CYCLE		PPA SORTIME	KSI SORTIME
4.76	.172	133	.6434E-02	.2613E-03	21.70	19.75

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TABLE D2-38

SPECIMEN NUMBER: 125-116						
SLOTTYPE: 2124-T861						
SPECIMEN ORIENTATION: LONGITUDINAL						
CONSTRAINTS: STIFFENED						
TEST TEMPERATURE: 149.0 K						
SPECIMEN THICKNESS: 3.23 MM (1.270 IN)						
MAXIMUM STRESS: 114.5 MPA (16.6 KSI)						
FREQUENCY: 200 CPS						
CYCLES TO FAILURE: 347 CYCLES PRIOR TO FAILURE						
KINAVI: 44.61 MPA SORTIME: 40.05 KSI SORTIME						
CRACK LENGTH	MM	IN	CYCLES	DELTA(S)/DELTA(N)	DELTA(Δ)/DELTA(N)	DELTA(Δ)/DELTA(N)
				MM/CYCLE	IN/CYCLE	MPA SORTIME
7.45	.293		1	.0748E-33	.3443E-04	17.47
9.17	.329		1151	.1753E-32	.4147E-04	17.14
9.12	.359		1766	.1972E-32	.7742E-04	17.74
9.42	.347		2119	.1797E-32	.7742E-04	17.74
11.79	.425		2699	.2154E-32	.9287E-04	19.39
11.71	.441		3149	.3165E-32	.1215E-03	20.10
12.53	.494		3317	.3473E-02	.1367E-03	20.44
13.51	.532		3596	.1374E-02	.1324E-03	21.71
14.70	.579		3450	.4938E-02	.1944E-03	22.45
15.44	.627		4231	.5567E-02	.2192E-03	23.67
17.45	.687		4472	.6301E-02	.2491E-03	24.62
18.58	.731		4151	.7873E-02	.3102E-03	25.72
21.62	.812		4911	.1313E-01	.3996E-03	26.83
21.45	.861		5119	.1157E-01	.4554E-03	27.79
23.55	.927		5179	.1537E-01	.6450E-03	28.47
25.23	.993		5288	.1743E-01	.6864E-03	29.99
27.14	1.069		5396	.1571E-01	.6144E-03	31.07
28.76	1.132		5531	.2112E-01	.8316E-03	32.06
31.43	1.198		5550	.2444E-01	.9623E-03	32.96
31.42	1.253		5637	.2501E-01	.9856E-03	33.96
31.43	1.332		5717	.2814E-01	.1134E-02	34.94
35.23	1.387		5767	.2475E-01	.1171E-02	35.81
38.44	1.456		5821	.4129E-01	.1624E-02	36.68
38.28	1.507		5856	.4028E-01	.1586E-02	37.57
39.37	1.574		5898			

TABLE D2-39

SPECIMEN NUMBER: 125-611						
SLOTTYPE: 2124-T861						
SPECIMEN ORIENTATION: LONGITUDINAL						
CONSTRAINTS: STIFFENED						
TEST TEMPERATURE: 149.0 K						
SPECIMEN THICKNESS: 3.35 MM (1.320 IN)						
MAXIMUM STRESS: 196.4 MPA (28.4 KSI)						
FREQUENCY: 200 CPS						
CYCLES TO FAILURE: 1 CYCLES PRIOR TO FAILURE						
KINAVI: 775 CYCLES						
(NET STRESS GREATER THAN 2.0 FTV)						
CRACK LENGTH	MM	IN	CYCLES	DELTA(S)/DELTA(N)	DELTA(Δ)/DELTA(N)	DELTA(Δ)/DELTA(N)
				MM/CYCLE	IN/CYCLE	MPA SORTIME
6.45	.250		1	.1803E-31	.7187E-33	34.38
7.37	.281		124	.2281E-31	.8979E-03	41.82
4.26	.163		142	.2511E-01	.9848E-03	43.84
4.11	.161		251	.3881E-31	.1528E-02	46.26
11.16	.430		334	.3445E-01	.1371E-02	48.77
11.11	.434		354	.3358E-01	.1157E-02	46.29
11.93	.464		413	.4451E-01	.1437E-02	51.07
12.44	.492		446	.9997E-01	.3814E-02	55.69
23.77	1.471		604	.2793E-00	.1137E-01	77.74
24.72	1.447		675	.1785E-00	.7724E-02	83.40
26.01	1.417		875	.2113E-00	.9174E-02	84.79
24.24	1.224		711	.1481E-00	.1517E-01	69.24
31.11	2.402		775	.2267E-00	.8871E-02	94.3E
31.41	2.340		741	.4441E-01	.1744E-01	54.44
36.44	2.769		750			
37.41	2.313		741			
38.31	3.143		745			
42.41	3.340		769			
45.70	3.356		771			
46.77	3.074		772			
49.16	3.571		773			
51.47	4.044		774			

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TABLE D2-40

SPECIMEN NUMBER: 125-373
SPECTIMEN CRITERIA: 125-373
CONSTRAINT: 125-373
TEST TEMPERATURE: 125-373
SPECIMEN THICKNESS: 125-373
MAXIMUM STRESS: 125-373
FREQUENCY: 125-373
Cycles to Failure: 284
KIMANI: 284 CYCLES PRIOR TO FAILURE
41.13 MPA SORTIM: 37.43 KSI SORTIM

CRACK LENGTH IN	CYCLES	DELTA(SI)/DELTA(IN) IN/CYCLE	DELTA(Stress Intensity) PPS SORTIM	DELTA(Stress Intensity) KSI SORTIM
4.31	1	.1279E-02	.5031E-04	17.22
7.32	833	.1203E-02	.5051E-04	16.30
8.97	1494	.1302E-02	.5433E-04	15.27
9.77	2157	.2100E-02	.5096E-04	20.73
10.49	2459	.3291E-02	.1200E-03	21.33
11.78	2963	.4036E-02	.1519E-03	22.32
12.46	3261	.4594E-02	.1794E-03	23.41
14.21	3531	.5661E-02	.2229E-03	24.31
15.08	3644	.6768E-02	.2903E-03	25.16
16.73	3859	.9703E-02	.3820E-03	26.11
17.44	3984	.4622E-02	.2587E-03	26.69
18.18	4096	.6224E-02	.3230E-03	27.58
19.13	4199	.1264E-01	.4979E-03	28.79
21.61	4433	.1398E-01	.5471E-03	30.25
23.34	4504	.1839E-01	.7224E-03	31.27
24.47	4594	.2344E-01	.8845E-03	32.39
26.27	4672	.2712E-01	.1060E-02	33.67
28.26	4746	.3811E-01	.1186E-02	34.93
30.35	4835	.3256E-01	.1202E-02	36.09
31.84	4869	.4994E-01	.1904E-02	37.21
33.54	4894	.4720E-01	.1861E-02	38.42
35.52	4938			

TABLE D2-41

SPECIMEN NUMBER: 125-473
SPECTIMEN CRITERIA: 125-473
CONSTRAINT: 125-473
TEST TEMPERATURE: 125-473
SPECIMEN THICKNESS: 125-473
MAXIMUM STRESS: 125-473
FREQUENCY: 125-473
Cycles to Failure: 1
KIMANI: 1 CYCLES PRIOR TO FAILURE
82.75 MPA SORTIM: 75.21 KSI SORTIM

CRACK LENGTH IN	CYCLES	DELTA(SI)/DELTA(IN) IN/CYCLE	DELTA(Stress Intensity) PPS SORTIM	DELTA(Stress Intensity) KSI SORTIM
5.35	1	.1452E-01	.5717E-03	34.48
7.79	291	.5152E-01	.2020E-02	42.52
8.79	322	.5336E-01	.2131E-02	45.10
9.76	366	.6150E-01	.2579E-02	48.02
11.74	402	.7940E-01	.3007E-02	50.60
11.32	427	.1464E+00	.9764E-02	53.41
13.19	447	.1240E+00	.4906E-02	50.77
14.15	472	.2739E+00	.1070E-01	55.54
16.34	480	.2942E+00	.1139E-01	62.12
17.14	489	.5192E+00	.2123E-01	64.67
18.42	493	.3864E+00	.1522E-01	67.48
20.16	532	.9449E+00	.3734E-01	70.34
21.11	534	.9410E+00	.3785E-01	72.27
22.35	566	.1169E+01	.4587E-01	74.43
23.72	538	.2910E+01	.1146E+00	77.17
24.47	599			

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TABLE D2-42

SPECIMEN NUMBER:		U125-4111	
SLOT TYPE:		2024-T861	
SPECIMEN ORIENTATION:		LONGITUDINAL	
CONSTRAINTS:		UNSTIFFENED	
ENVIRONMENT:		CAR AIR	
TEST TEMPERATURE:		422.1 K	
SPECIMEN THICKNESS:		1.25 MM (1.25E-01 IN)	
MAXIMUM STRESS:		112.6 MPa (17.2 KSI)	
FREQUENCY:		280 CPM	
CYCLES TO FAILURE:		5720 CYCLES	
(HARD) 391 CYCLES PRIOR TO FAILURE:		45.2R MPa SORTING; 41.21 KSI SORTING	

CRACK LENGTH IN	CYCLES	DELTA(I)/DELTA(II) IN/CYCLE	DELTA(III)/DELTA(IV) IN/CYCLE	DELTA(III) STRESS MPa SORTING	DELTA(III) INTENSITY KSI SORTING
7.45	233				
7.50	314	.678E-03	.264E-04	17.57	16.99
8.72	1514	.992E-03	.390E-04	19.24	16.63
9.12	1932	.11 EC-02	.506E-04	19.00	17.29
10.16	2434	.167E-02	.659E-04	19.78	17.99
11.95	2858	.171E-02	.676E-04	20.58	18.78
11.74	3294	.200E-02	.787E-04	21.37	19.41
12.44	3721	.252E-02	.995E-04	22.74	20.24
13.69	4089	.296E-02	.116E-03	23.17	21.04
14.45	4213	.427E-02	.166E-03	23.97	21.72
15.53	4423	.465E-02	.183E-03	24.68	22.43
16.45	4596	.557E-02	.219E-03	25.45	23.16
17.54	4790	.631E-02	.211E-03	26.26	23.98
20.41	5236	.734E-02	.289E-03	27.94	25.43
22.48	5343	.113E-01	.417E-03	29.77	27.10
24.49	5552	.126E-01	.499E-03	31.00	28.29
26.41	5699	.130E-01	.512E-03	32.48	29.53
28.16	5817	.165E-01	.650E-03	31.76	30.72
29.44	6016	.149E-01	.549E-03	34.90	31.76
31.37	5992	.232E-01	.915E-03	35.98	32.65
32.43	6042	.243E-01	.959E-03	36.45	33.53
34.44	6119	.274E-01	.106E-02	37.00	34.58
36.41	6177	.247E-01	.974E-03	35.13	33.61
38.72	6237	.316E-01	.114E-02	40.18	36.53
39.72	6790	.344E-01	.135E-02	41.17	37.47
41.71	6329	.436E-01	.179E-02	42.37	38.52

TABLE D2-43

SPECIMEN NUMBER:		U125-477	
SLOT TYPE:		2024-T861	
SPECIMEN ORIENTATION:		LONGITUDINAL	
CONSTRAINTS:		UNSTIFFENED	
ENVIRONMENT:		CAR AIR	
TEST TEMPERATURE:		422.0 K	
SPECIMEN THICKNESS:		1.25 MM (1.25E-01 IN)	
MAXIMUM STRESS:		112.6 MPa (17.2 KSI)	
FREQUENCY:		280 CPM	
CYCLES TO FAILURE:		4970 CYCLES	
(HARD) 144 CYCLES PRIOR TO FAILURE:		41.63 MPa SORTING; 37.84 KSI SORTING	

CRACK LENGTH IN	CYCLES	DELTA(I)/DELTA(II) IN/CYCLE	DELTA(III)/DELTA(IV) IN/CYCLE	DELTA(III) STRESS MPa SORTING	DELTA(III) INTENSITY KSI SORTING
7.36	1				
8.72	934	.136E-02	.419E-04	17.60	16.01
9.12	1491	.136E-02	.536E-04	18.58	16.41
10.16	2089	.180E-02	.740E-04	19.60	17.43
11.16	2496	.232E-02	.915E-04	20.54	18.79
12.17	2819	.312E-02	.119E-03	21.71	19.78
13.79	3191	.136E-02	.132E-03	22.77	20.68
14.74	3419	.437E-02	.172E-03	23.57	21.65
16.16	3647	.627E-02	.246E-03	24.48	22.25
17.50	3795	.545E-02	.230E-03	25.17	23.09
18.45	3930	.794E-02	.312E-03	26.71	23.94
19.87	4056	.966E-02	.340E-03	27.71	24.78
21.45	4157	.156E-01	.617E-03	28.10	25.75
22.34	4296	.137E-01	.535E-03	26.50	26.94
24.46	4399	.227E-01	.897E-03	31.11	28.38
27.14	4523	.217E-01	.808E-03	32.76	29.81
29.31	4443	.353E-01	.139E-02	34.17	31.23
31.74	4654	.291E-01	.114E-02	35.43	32.68
33.71	4792	.446E-01	.176E-02	37.12	34.78
36.32	4746	.367E-01	.144E-02	38.12	36.69
38.19	4772	.563E-01	.221E-02	39.89	38.57

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TABLE D2-44

SPECIMEN NUMBER			12C-1114		
SPECIMEN ORIENTATION			LONGITUDINAL		
CONSTRAINT			STIFFNESS		
TEST TEMPERATURE			450 °K		
SPECIMEN THICKNESS			3.25 MM (.1280 IN)		
MAXIMUM STRESS			118.5 MPA (17.2 KSI)		
R-RATIO			7:37		
CYCLES TO FAILURE			200 CPM		
K(MAV) 442 CYCLES PRIOR TO FAILURE			47.62 MPA SQRT(IN) 43.33 KSI SQRT(IN)		
CRACK LENGTH MM	IN	CYCLES	DELTA(K)/DELTA(N) MPA/CYCLE	DELTA(I)/DELTA(N) IN/CYCLE	DELTA(STRESS INTENSIVITY) MPA SQRT(IN)
7.76	.238	1	.1029E+02	.4550E-04	17.5F
4.14	.1271	859	.1174E+02	.4084E-04	18.4F
4.42	.1351	1439	.1443E+02	.5669E-04	19.2C
4.47	.1373	1949	.1967E+02	.6169E-04	19.88
11.24	.443	2441	.1435E+02	.8651E-04	20.54
11.79	.425	2845	.2355E+02	.1037E-03	21.17
11.52	.454	3151	.2344E+02	.1129E-03	22.5F
11.76	.542	3413	.3344E+02	.1314E-03	23.81
14.34	.550	4117	.3817E+02	.1507E-03	24.48
14.29	.622	4357	.5042E+02	.1944E-03	25.21
14.14	.610	4625	.5750E+02	.2264E-03	25.9F
17.19	.673	4831	.8595E+02	.2242E-03	26.60
14.32	.728	4849	.9935E+02	.2294E-03	27.31
14.71	.776	4873	.9511E+02	.3744E-03	27.4F
14.41	.754	5044	.6467E+02	.2544E-03	28.56
22.34	.811	5225	.8295E+02	.3268E-03	29.33
22.33	.967	5410	.1165E+03	.4544E-03	30.61
23.41	.929	5534	.9366E+02	.3645E-03	31.52
24.41	.969	5642	.1523E+03	.5990E-03	32.78
26.11	1.028	5740	.1595E+03	.6274E-03	33.38
27.41	1.044	5811	.1514E+03	.5961E-03	34.14
21.19	1.145	5933	.1404E+03	.7414E-03	35.4F
31.31	1.213	6024	.1655E+03	.6515E-03	36.54
32.43	1.277	6122	.1959E+03	.7713E-03	37.53
33.41	1.335	6137	.2302E+03	.9652E-03	38.58
36.74	1.448	6274	.2193E+03	.8633E-03	39.48
37.14	1.460	6338	.2715E+03	.1069E+02	40.40
38.42	1.510	6331	.1214E+03	.1267E+02	41.34
39.93	1.572	6435	.1134E+03	.1234E+02	42.23
41.34	1.629	6441	.1112E+03	.1221E+02	43.06
42.42	1.678	6521	.1340E+03	.1339E+02	43.91
44.11	1.737	6535	.4644E+03	.1824E+02	44.40
46.11	1.792	6535			46.77

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OF POOR QUALITY

FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974

TABLE D2-45

SPECIMEN NUMBER										LONGITUDINAL STRESS									
SPECIMEN ORIENTATION										STRESS									
TEST YIELD STRESS										STRESS									
SPECIMEN THICKNESS										STRESS									
MAXIMUM STRESS										STRESS									
PRECRACK										STRESS									
CYCLES TO FAILURE										STRESS									
1 CYCLES PRIOR TO FAILURE										STRESS									
KINAXI										NET STRESS GREATER THAN 0.9 FTYI									

CPACK	LENGTH	CYCLES	DELTA(I)/DELTA(IN)	DELTA(II)/DELTA(IIIN)	DELTA(III)/DELTA(IIIIIN)	DELTA(IV)/DELTA(IIIVIN)	DELTA(V)/DELTA(IIVIN)	DELTA(VI)/DELTA(IIVIN)	DELTA(VII)/DELTA(IIVIN)	DELTA(VIII)/DELTA(IIVIN)	DELTA(IX)/DELTA(IIVIN)	DELTA(X)/DELTA(IIVIN)	DELTA(XI)/DELTA(IIVIN)	DELTA(XII)/DELTA(IIVIN)	DELTA(XIII)/DELTA(IIVIN)	DELTA(XIV)/DELTA(IIVIN)	DELTA(XV)/DELTA(IIVIN)	DELTA(XVI)/DELTA(IIVIN)	DELTA(XVII)/DELTA(IIVIN)	DELTA(XVIII)/DELTA(IIVIN)	DELTA(XIX)/DELTA(IIVIN)	DELTA(XX)/DELTA(IIVIN)	DELTA(XXI)/DELTA(IIVIN)	DELTA(XXII)/DELTA(IIVIN)	DELTA(XXIII)/DELTA(IIVIN)	DELTA(XXIV)/DELTA(IIVIN)	DELTA(XXV)/DELTA(IIVIN)	DELTA(XXVI)/DELTA(IIVIN)	DELTA(XXVII)/DELTA(IIVIN)	DELTA(XXVIII)/DELTA(IIVIN)	DELTA(XXIX)/DELTA(IIVIN)	DELTA(XXX)/DELTA(IIVIN)	DELTA(XXXI)/DELTA(IIVIN)	DELTA(XXXII)/DELTA(IIVIN)	DELTA(XXXIII)/DELTA(IIVIN)	DELTA(XXXIV)/DELTA(IIVIN)	DELTA(XXXV)/DELTA(IIVIN)	DELTA(XXXVI)/DELTA(IIVIN)	DELTA(XXXVII)/DELTA(IIVIN)	DELTA(XXXVIII)/DELTA(IIVIN)	DELTA(XXXIX)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	DELTA(XXXIIN)/DELTA(IIVIN)	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FINAL REPORT

FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
October 1974

TABLE D2-46

SPECIMEN NUMBER: 125-318		ALLOY TYPE: 2024-T861		TEST TEMPERATURE: 125°F		
SPECIMEN ORIENTATION: TRANSVERSE		CONSTRAINTS: STIFFENED		TEST FREQUENCY: 1000 Hz		
TEST ENVIRONMENT: LAB AIR		SPECIMEN THICKNESS: 3.23 MM (0.127 IN)		MAXIMUM STRESS: 118.6 MPA (17.2 KSI)		
FREQUENCY: 1000 Hz		CYCLES TO FAILURE: 277		437 CYCLES		
K(MAX): 277 CYCLES PRIOR TO FAILURE		48.62 MPA SORT(M): 36.96 KSI SORT(M)				
CRACK LENGTH MM	IN	CYCLES	DELTA(I)/DELTA(M) MPa/CYCLE	DELTA(I)/DELTA(M) KSI/CYCLE	DELTA(Stress Intensity) MPa SORT(M)	DELTA(Stress Intensity) KSI SORT(M)
7.09	.279					
7.82	.307	444	.1495E-02	.5729E-04	17.26	15.71
8.52	.335	995	.1418E-02	.5582E-04	18.07	16.45
9.17	.361	1373	.1724E-02	.6786E-04	19.92	17.13
9.93	.391	1705	.2295E-02	.9036E-04	15.57	17.91
11.56	.455	2311	.2595E-02	.1021E-03	20.77	18.90
12.21	.481	2514	.3245E-02	.1279E-03	21.46	19.99
12.30	.488	2741	.3295E-02	.1247E-03	22.44	20.45
13.53	.513	2844	.4423E-02	.1741E-03	23.07	20.99
14.31	.563	3033	.5269E-02	.2074E-03	23.69	21.56
15.98	.629	3321	.6231E-02	.2455E-03	24.74	22.51
18.76	.711	3521	.9633E-02	.3714E-03	26.27	23.91
20.92	.824	3831	.1123E-01	.4027E-03	24.18	25.65
22.61	.891	3838	.1794E-01	.6923E-03	25.87	27.18
23.87	.944	3971	.1935E-01	.7226E-03	30.95	28.17
25.97	1.019	4156	.2234E-01	.8612E-03	32.08	29.28
27.12	1.068	4126	.1782E-01	.7014E-03	33.16	30.17
28.71	1.143	4137	.2697E-01	.1.60E-02	34.21	31.14
32.26	1.269	4249	.3143E-01	.1237E-02	35.89	32.66
33.43	1.311	4324	.3944E-01	.1468E-02	37.31	33.95
34.94	1.372	4356	.4562E-01	.1795E-02	38.14	34.71

TABLE D2-47

SPECIMEN NUMBER: 125-318		ALLOY TYPE: 2024-T861		TEST TEMPERATURE: 125°F	
SPECIMEN ORIENTATION: TRANSVERSE		CONSTRAINTS: STIFFENED		TEST FREQUENCY: 1000 Hz	
TEST ENVIRONMENT: LAB AIR		SPECIMEN THICKNESS: 3.35 MM (0.133 IN)		MAXIMUM STRESS: 195.4 MPA (28.4 KSI)	
FREQUENCY: 1000 Hz		CYCLES TO FAILURE: 1		455 CYCLES	
K(MAX): 1 CYCLES PRIOR TO FAILURE		46.45 MPA SORT(M): 37.96 KSI SORT(M)			

CRACK LENGTH MM	IN	CYCLES	DELTA(I)/DELTA(M) MPA/CYCLE	DELTA(I)/DELTA(M) KSI/CYCLE	DELTA(Stress Intensity) MPa SORT(M)	DELTA(Stress Intensity) KSI SORT(M)
7.09	.277					
7.98	.304	114	.1503E-01	.6313E-03	37.94	36.44
7.72	.304	164	.3387E-01	.1206E-02	40.23	38.61
8.73	.368	211	.4311E-01	.1697E-02	47.52	39.78
9.74	.377	244	.4463E-01	.1753E-02	45.25	41.18
11.05	.439	240	.6.87E-01	.2396E-02	47.64	43.35
11.39	.447	314	.8261E-01	.3252E-02	49.63	45.17
12.65	.491	325	.1745E-01	.3961E-02	51.74	47.29
13.43	.534	342	.1329E-01	.4.57E-02	53.94	49.59
14.35	.553	342	.1127E-01	.4.643E-02	56.04	51.22
15.13	.597	393	.1745E-01	.7.26E-02	58.25	53.11
15.44	.628	744	.2344E-01	.8273E-02	61.53	55.9
16.10	.645	747	.2444E-01	.8796E-02	63.44	57.74
16.90	.669	811	.1247E-01	.4.891E-02	65.46	60.63
19.97	.782	419	.2365E-01	.9313E-02	67.49	61.79
21.19	.869	425	.4778E-01	.1634E-01	73.24	63.92
22.74	.914	433	.3942E-01	.1588E-01	73.17	66.54
24.37	.961	441	.4561E-01	.1796E-01	74.14	69.51
27.24	1.093	443	.6473E-01	.2.551E-01	81.31	73.77
28.58	1.250	452	.8377E-01	.3373E-01	85.49	77.90
30.35	1.358	454	.1375E-01	.5413E-01	84.35	80.40
32.05	1.429	455	.1804E-01	.7057E-01	90.34	82.17

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2024-T861 AND 2124-T851

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TABLE D2-48

SPECIMEN NUMBER				125-219			
SPECIMEN ORIENTATION				2024-T861			
CONSTRAINT				LONGITUDINAL			
ENVIRONMENT				STIFFENED			
TEST METHOD				LAW 100			
SPECIMEN THICKNESS				1.71 MM (0.067 IN)			
MAXIMUM STRESS				115.0 MPa (16.7 KSI)			
FREQUENCY				2.5 KHz			
CYCLES TO FAILURE				14,770 CYCLES			
K(MAX)				(NET STRESS GREATER THAN 1.48 FTS)			
2 CYCLES PRIOR TO FAILURE							
CRACK LENGTH	MM	IN	DELTA K(1)/DELTA K(2)	DELTA K(1)/DELTA K(2)	DELTA STRESS INTENSITY	MPa (KSI)	MPa (KSI)
9.36	0.37	1469	0.510E-01	0.194E-04	10.37	9.17	
11.36	0.45	3741	0.411E-01	0.191E-04	10.51	9.36	
11.39	0.45	4753	0.617E-01	0.253E-04	10.97	9.46	
11.41	0.45	7298	0.818E-01	0.322E-04	11.29	11.28	
12.41	0.49	6113	0.914E-01	0.314E-04	11.44	11.59	
13.39	0.53	6654	0.917E-01	0.357E-04	11.45	11.87	
13.44	0.54	7342	0.251E-02	0.442E-04	12.28	11.18	
14.65	0.58	7852	0.118E-02	0.546E-04	13.64	11.50	
15.26	0.60	8623	0.131E-02	0.535E-04	13.37	11.43	
15.31	0.60	9111	0.153E-02	0.614E-04	13.37	12.16	
17.25	0.68	9811	0.191E-02	0.714E-04	13.71	12.49	
18.72	0.74	11111	0.246E-02	0.913E-04	14.23	12.95	
19.61	0.77	11444	0.243E-02	0.999E-04	14.70	13.38	
21.43	0.84	10843	0.322E-02	0.127E-03	15.12	13.76	
22.49	0.88	11376	0.342E-02	0.134E-03	15.64	14.27	
23.67	0.93	11636	0.365E-02	0.143E-03	16.21	14.74	
23.63	1.01	12174	0.467E-02	0.183E-03	16.74	15.24	
24.44	1.07	12375	0.467E-02	0.183E-03	17.33	15.77	
24.12	1.01	12561	0.344E-02	0.214E-03	17.41	16.21	
24.17	1.04	12737	0.419E-02	0.244E-03	18.74	16.40	
24.44	1.04	13114	0.456E-02	0.219E-03	18.77	17.12	
24.44	1.04	13114	0.799E-02	0.441E-03	19.15	17.43	
24.44	1.04	13114	0.956E-02	0.354E-03	19.51	17.44	
24.44	1.04	13114	0.927E-02	0.351E-03	20.11	18.31	
24.44	1.04	13114	0.914E-02	0.343E-03	20.53	18.68	
24.44	1.04	13114	0.919E-02	0.371E-03	20.31	19.14	
24.44	1.04	13114	0.117E-01	0.475E-03	21.34	19.42	
24.44	1.04	13114	0.957E-02	0.377E-03	21.79	19.43	
24.44	1.04	13114	0.162E-01	0.418E-03	22.40	21.38	
24.44	1.04	13114	0.161E-01	0.534E-03	23.01	21.94	
24.44	1.04	13114	0.159E-01	0.434E-03	23.57	21.45	
24.44	1.04	13114	0.167E-01	0.611E-03	24.15	21.97	
24.44	1.04	13114	0.142E-01	0.561E-03	24.75	22.53	
24.44	1.04	13114	0.174E-01	0.687E-03	25.33	23.15	
24.44	1.04	13114	0.197E-01	0.779E-03	25.31	23.44	
24.44	1.04	13114	0.214E-01	0.921E-03	25.57	24.18	
24.44	1.04	13114	0.219E-01	0.825E-03	27.19	24.75	
24.44	1.04	13114	0.240E-01	0.944E-03	27.78	25.29	
24.44	1.04	13114	0.244E-01	0.971E-03	28.45	25.89	
24.44	1.04	13114	0.227E-01	0.894E-03	29.11	26.49	
24.44	1.04	13114	0.244E-01	0.982E-03	29.73	27.16	
24.44	1.04	13114	0.214E-01	0.921E-03	31.35	27.65	
24.44	1.04	13114	0.321E-01	0.126E-02	31.12	28.32	
24.44	1.04	13114	0.322E-01	0.124E-02	31.47	28.99	
24.44	1.04	13114	0.551E-01	0.216E-02	33.45	31.44	
F	24.44	13114	0.416E-01	0.140E-02	35.14	32.02	
F	24.44	13114	0.364E-01	0.144E-02	35.38	32.76	
F	24.44	13114	0.141E-01	0.150E-02	36.59	33.30	
F	24.44	13114	0.351E-01	0.150E-02	37.11	33.77	
F	24.44	13114	0.452E-01	0.175E-02	37.41	34.41	
F	24.44	13114	0.435E-01	0.200E-02	38.56	35.19	
F	24.44	13114	0.452E-01	0.340E-02	39.44	35.91	
F	24.44	13114	0.558E-01	0.220E-02	40.42	36.78	
F	24.44	13114	0.762E-01	0.303E-02	41.28	37.57	
F	24.44	13114	0.127E-01	0.503E-02	42.69	38.67	
F	24.44	13114	0.114E-01	0.450E-02	43.54	39.62	

D2-48 (CON'T.)

F	94.61	3.725	16029	.1770E+00	.7800E-02	46.48	46.48
F	94.39	3.795	16039	.1307E+00	.6900E-02	49.36	49.29
F	97.79	3.880	16049	.2030E+00	.6600E-02	48.47	42.29
F	99.92	3.930	16059				
F	81.73	6.885	16069				
F	80.76	6.885	16074				
F	89.16	6.148	16077				

(NET STRESS GREATER THAN 8.9 FTV)
(NET STRESS GREATER THAN 8.9 FTV)
(NET STRESS GREATER THAN 8.9 FTV)

TABLE D2-49

SPECIMEN NUMBER				129-117			
SPFCINEN CRYSTALLINITY				2024-T861			
CONSTRAINT				LONGITUDINAL			
TEST TO FAILURE				STRESS			
CRACK THICKNESS				1.27 IN (32.5 MM)			
MAXIMUM STRESS				109.8 MPA (15.7 KSI)			
FREQUENCY				2700 CYCLES			
CYCLES TO FAILURE				95.61 MPA SORTIMIT 46.46 KSI SORTIMIT			
KINAK) 33 CYCLES PRIOR TO FAILURE							
CRACK LENGTH IN	MM	CYCLES	DELTA 1/DELTA 2 IN/CYCLE	DELTA STRESS MPA SORTIMIT	INTENSITY KSI SORTIMIT		
7.46	191	1	.3041E-02	.1397E-03	15.36	13.98	
9.17	232	214	.2935E-02	.1244E-03	16.23	14.77	
9.77	248	413	.3537E-02	.1550E-03	17.12	15.50	
13.15	333	643	.5902E-02	.2300E-03	17.74	16.10	
14.79	375	1105	.5796E-02	.2242E-03	19.47	16.81	
16.49	417	1732	.7725E-02	.3041E-03	19.17	17.45	
17.63	448	1742	.8110E-02	.3194E-03	19.91	18.12	
18.77	478	1421	.7500E-02	.2944E-03	21.57	18.72	
19.9	503	1411	.9039E-02	.3872E-03	21.17	19.22	
19.45	494	1747	.1107E-01	.3038E-03	21.65	19.70	
19.12	488	1732	.1175E-01	.4627E-03	22.34	20.10	
19.17	489	1675	.1277E-01	.5124E-03	22.55	20.32	
19.42	493	1714	.1347E-01	.4332E-03	23.34	21.00	
19.15	486	1742	.1460E-01	.6160E-03	23.51	21.49	
19.02	484	1845	.1330E-01	.5270E-03	24.14	21.97	
20.18	514	1490	.2147E-01	.8472E-03	24.91	22.57	
21.17	540	1464	.2317E-01	.7921E-03	25.62	23.32	
23.17	591	2035	.1814E-01	.7152E-03	26.44	24.06	
24.71	627	2197	.2665E-01	.1049E-02	27.24	24.83	
25.43	651	2114	.2444E-01	.9774E-03	28.34	25.55	
27.19	695	2370	.3305E-01	.1301E-02	28.41	26.22	
28.44	728	2222	.2415E-01	.1108E-02	28.54	26.90	
31.11	793	2294	.3574E-01	.1479E-02	29.64	27.92	
34.57	880	2314	.3556E-01	.1401E-02	32.45	29.53	
36.45	930	2410	.4444E-01	.1754E-02	33.91	30.86	
39.15	995	2474	.4762E-01	.1875E-02	34.92	31.70	
39.75	1008	2513	.5011E-01	.1871E-02	34.91	32.58	
41.53	1065	2643	.5527E-01	.2333E-02	36.67	33.37	
43.11	1105	2573	.5427E-01	.2333E-02	37.63	34.24	
45.19	1155	2694	.7112E-01	.2400E-02	38.59	35.12	
46.77	1195	2623	.1474E+00	.5402E-02	40.84	36.66	
51.74	1318	2744	.1119E+00	.4403E-02	41.42	37.84	
53.47	1365	2673	.9657E-01	.3802E-02	43.75	39.16	
55.51	1415	2641	.1524E+00	.6608E-02	44.76	40.35	
57.17	1455	2649	.1101E+00	.4333E-02	45.77	41.16	
61.72	1568	2714	.1577E+00	.6258E-02	46.49	42.48	

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TABLE D2-50

SPECIMEN NUMBER							125-873						
SPECIMEN ORIENTATION							2024-T861						
CONSTRAINTS							2124-T851						
TEST TEMPERATURE							STIFFNESS						
SPECIMEN THICKNESS							100 PSI						
MAXIMUM TEST RATE							3.25 MM (1/8")						
FREQUENCY							112.4 MPa (16.2 KSI)						
CYCLES TO FAILURE							200 CPS						
KINEMATICS							12257 CYCLES						
1 CYCLE PRIOR TO FAILURE							90.9% MPa SORTING (12.7% KSI SORTING)						
COACK LENGTH	IN	CYCLES	DELTA K (1/DELTA IN)	IN/CYCLE	DELTA STRESS INTENSIVITY	MPa (KSI)	DELTA STRESS INTENSIVITY	MPa (KSI)	DELTA STRESS INTENSIVITY	MPa (KSI)	DELTA STRESS INTENSIVITY	MPa (KSI)	DELTA STRESS INTENSIVITY
9.19	.376	1156	.5625E-01	.2216E-04	10.83	9.13							
9.79	.393	2714	.6882E-03	.2789E-04	10.37	9.44							
11.78	.474	2813	.9641E-03	.1914E-04	10.74	9.77							
11.36	.471	4792	.8677E-01	.3616E-04	11.24	10.24							
12.49	.517	4642	.1385E-02	.5655E-04	11.76	10.71							
13.47	.531	5796	.1115E-02	.5177E-04	12.12	11.33							
14.19	.550	5747	.1455E-02	.5733E-04	12.43	11.31							
15.16	.513	6746	.1495E-02	.7662E-04	12.70	11.66							
15.39	.619	6723	.1577E-02	.7768E-04	13.14	12.00							
17.49	.698	7344	.2432E-02	.9573E-04	13.70	12.47							
18.31	.774	7752	.2502E-02	.9852E-04	14.23	12.95							
19.51	.758	8031	.3797E-02	.1415E-03	14.64	13.32							
21.74	.818	8732	.1751E-02	.1677E-03	15.19	13.92							
22.45	.931	8840	.6534E-02	.1785E-03	15.43	14.40							
24.41	.948	9751	.6234E-02	.1669E-03	16.46	14.97							
24.14	1.037	9842	.5273E-02	.2078E-03	17.74	15.50							
27.44	1.111	9895	.5374E-02	.2098E-03	17.44	16.05							
28.39	1.134	11251	.6614E-02	.2695E-03	18.38	16.73							
32.11	1.230	10457	.7451E-02	.3091E-03	19.27	17.36							
33.14	1.317	10736	.8001E-02	.3151E-03	19.59	17.82							
34.16	1.347	10855	.9214E-02	.3630E-03	20.15	19.34							
37.15	1.440	11031	.1164E-01	.4545E-03	21.76	18.90							
38.21	1.563	11172	.1249E-01	.4919E-03	21.39	19.47							
41.70	1.622	11319	.1467E-01	.5741E-03	22.17	20.09							
43.11	1.647	11674	.1584E-01	.6238E-03	22.71	20.66							
45.11	1.934	11843	.1744E-01	.7023E-03	23.66	21.35							
46.18	1.947	11843	.2177E-01	.8573E-03	24.27	22.05							
48.11	1.911	11754	.2337E-01	.9200E-03	24.97	22.60							
52.15	2.003	11852	.2704E-01	.9034E-03	25.40	23.30							
54.74	2.115	11917	.1674E-01	.1444E-02	26.46	24.08							
57.44	2.271	12035	.1672E-01	.1566E-02	27.40	24.93							
61.49	2.389	12078	.4354E-01	.1598E-02	28.14	25.82							
62.17	2.477	12129	.4460E-01	.1754E-02	28.79	26.66							
66.17	2.775	12157	.4402E-01	.3503E-02	30.14	27.43							
67.11	2.856	12177	.4525E-01	.3753E-02	30.96	28.16							
68.15	2.730	12137	.1270E+00	.5000E-02	31.77	28.92							
71.71	2.810	12712	.2705E+00	.1067E-01	33.07	30.00							
74.46	3.110	12223	.3044E+00	.1200E-01	34.64	31.38							
76.75	3.120	12712	.2286E+00	.9000E-02	35.61	32.40							
82.74	3.210	12442	.2794E+00	.1103E-01	36.72	33.42							
84.17	3.310	12747	.4164E+00	.1630E-01	37.62	34.42							
87.14	3.460	12252	.7520E+00	.3200E-01	39.22	35.69							
89.75	3.535	12255	.6150E+00	.2500E-01	40.56	37.60							
97.74	3.910	12256	.7407E+00	.2450E+00	43.22	39.34							

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TABLE D2-51

SPECIMEN NUMBER						
SPECKLE COORDINATE						
TEST TEMPERATURE						
SPECIMEN TO FAILURE						
PART NO.						
FREQUENCY						
CYCLES TO FAILURE						
KIMAN 1 CYCLES PRIOR TO FAILURE						
62.93 MPa SORTING 57.27 ksi SORTING						
CRACK LENGTH	IN	CYCLES	DELTA K(I)/DELTA(N)	DELTA K(II)/DELTA(N)	DELTA K(III)/DELTA(N)	DELTA K(IV)/DELTA(N)
MPa	IN		MPa	IN	MPa	IN
7.44	.333	1	.3892E-02	.1532E-03	19.21	13.86
7.47	.310	110	.3672E-02	.1444E-03	19.73	14.32
9.01	.338	245	.4302E-02	.1694E-03	18.39	14.92
9.25	.366	458	.4357E-02	.1719E-03	17.03	15.98
9.71	.390	689	.5120E-02	.2131E-03	17.45	15.91
11.24	.435	671	.2544E-02	.3129E-03	17.95	16.36
11.99	.432	750	.1547E-01	.6093E-03	18.68	17.00
12.32	.473	821	.1674E-01	.5741E-03	19.42	17.60
12.81	.524	891	.1646E-01	.5861E-03	19.44	18.19
13.44	.610	929	.1736E-01	.6033E-03	20.52	18.67
14.15	.659	967	.2274E-01	.8171E-03	21.36	19.17
14.32	.597	1012	.2384E-01	.8130E-03	21.71	19.75
14.39	.624	1092	.4103E-01	.1614E-02	22.44	20.42
14.47	.668	1077	.1582E-01	.6239E-03	23.20	21.11
14.15	.714	1391	.2544E-01	.1175E-02	24.00	21.04
15.34	.761	1191	.4915E-01	.1933E-02	24.05	22.06
21.51	.866	1235	.3600E-01	.1339E-02	26.21	23.05
F	22.44	.951	.9527E-01	.2333E-02	26.90	24.40
F	24.74	.935	.1316E-03	.6008E-02	28.09	25.56
F	26.10	1.335	.0594E-01	.3562E-02	29.67	26.95
F	28.96	1.140	.6310E-01	.1700E-01	30.85	28.00
F	31.11	1.225				

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2024-T861 AND 2124-T851

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TABLE D2-52

SPECIMEN NUMBER			MILS-612		
SPECIMEN CATEGORY			LONGITUDINAL		
CONSTRAINT			UNSTIFFENED		
TEST TEMPERATURE			420° F		
SPEECH VOLUME			1.35 MM (0.053 IN)		
PAPUPP			145.4 MPa (21.0 KSI)		
CYCLES TO FAILURE			289 CYCLES		
1 CYCLES PRIOR TO FAILURE			NET STRESS GREATER THAN 7.9 FTVI		
CRACK LENGTH	CYCLES	DELTA K(I)/DELTA K(II)	DELTA K(I)/DELTA K(II)	DELTA K(I)/DELTA K(II)	DELTA K(I)/DELTA K(II)
MM		MM/CYCLE	IN/CYCLE	MPA SQR(TIME)	KSI SQR(TIME)
4.40	1	.0153E-02	.3684E-03	32.54	29.43
4.11	1.2	.1344E-01	.6175E-03	25.10	21.94
4.15	2.45	.1477E-01	.5795E-03	37.50	34.13
4.47	716	.1417E-01	.7156E-03	39.32	35.79
7.44	394	.7117E-01	.4333E-03	41.37	37.80
4.10	462	.3147E-01	.1253E-02	43.13	39.25
4.75	533	.3415E-01	.1344E-02	44.72	40.89
3.71	534	.2560E-01	.1165E-02	45.55	42.36
1.422	596	.4607E-01	.1817E-02	48.59	44.22
1.429	633	.4747E-01	.1640E-02	50.34	45.41
11.47	662	.4377E-01	.2391E-02	52.32	47.34
12.43	697	.4677E-01	.1822E-02	53.94	49.09
13.35	727	.7134E-01	.2770E-02	55.43	50.81
14.13	749	.6341E-01	.2504E-02	57.44	52.31
14.34	772	.6785E-01	.2455E-02	59.30	53.69
15.43	773	.6691E-01	.2595E-02	60.53	55.08
16.24	815	.7127E-01	.2803E-02	62.32	56.62
17.13	838	.4260E-01	.3567E-02	63.41	58.07
17.41	853	.1271E+00	.4210E-02	65.41	59.53
19.67	865	.1229E+00	.4437E-02	64.13	62.00
21.45	894	.1474E+00	.5803E-02	70.71	64.35
21.15	904	.1497E+00	.5895E-02	72.31	65.81
22.11	919	.2145E+00	.4204E-02	74.01	67.35
22.45	927				
		.2214E+00	.4714E-02	76.45	69.57
24.45	976	.2191E+00	.4620E-02	82.26	74.86
26.41	1023	.3271E+00	.1280E-01	94.57	86.15
30.14	1033				
40.37	1043				
43.33	1051				
45.31	1055				
47.79	1058				
49.44	1061				
52.71	1063				
53.73	1064				
55.60	1065				
57.85	1066				
61.75	1067				

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FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

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TABLE D2-53

SPECTRA NUMBER:						
SPECTRA TYPE:						
SPECTRA ORIENTATION:						
CONSTRAINTS:						
TEST TYPE/MEASUREMENT:						
SPECTRA TYPICNESS:						
MAXIMUM STRESS:						
RATIO:						
FREQUENCY:						
CYCLES TO FAILURE:						
K(MPa) 1 CYCLES PRIOR TO FAILURE:						
91.64 MPa SORTING: 83.43 KSI SORTING:						
U175-214						
2024-T861						
LONGITUDINAL						
UNSTRESSING						
LAB #18						
4500 K						
1.23 MM (1.2308 IN)						
110.6 MPa (17.7 KSI)						
200 CPS						
7071 CYCLES						
CRACK LENGTH	IN	CYCLES	DELTA(S)/DELTA(IN)	DELTA(Stress Intensity)	DELTA(Stress Intensity)	DELTA(Stress Intensity)
IN	IN		IN/CYCLE	MPa Sqrt(In)	KSI Sqrt(In)	KSI Sqrt(In)
0.14	0.14	820	.0343E-03	.3559E-04	17.57	15.99
0.17	0.17	1623	.1138E-02	.4471E-04	18.44	16.83
0.19	0.19	2130	.1201E-02	.4727E-04	19.79	17.55
1.071	0.22	2635	.2114E-02	.8321E-04	20.17	19.35
1.157	0.45	3135	.1837E-02	.7232E-04	21.15	19.25
1.206	0.46	3135	.2280E-02	.8975E-04	22.32	20.04
1.304	0.51	3866	.3803E-02	.1182E-03	22.90	22.03
1.402	0.54	4214	.7593E-02	.1414E-03	23.44	21.73
1.574	0.62	4749	.5334E-02	.2180E-03	24.93	22.60
1.777	0.71	4751	.5627E-02	.2215E-03	26.05	23.70
1.857	0.73	4891	.6135E-02	.2408E-03	27.16	24.72
1.944	0.73	5217	.7472E-02	.3099E-03	27.94	25.37
2.111	0.81	5181	.8467E-02	.3333E-03	28.93	26.24
2.177	0.93	5190	.9356E-02	.3565E-03	30.34	27.35
2.402	0.94	5734	.1185E-01	.4681E-03	31.29	28.40
2.406	1.03	5790	.1447E-01	.5699E-03	32.53	29.49
2.416	1.17	5794	.1777E-01	.5622E-03	33.49	30.45
2.708	1.14	5932	.1574E-01	.6294E-03	34.93	31.79
2.702	1.20	4095	.2149E-01	.8618E-03	36.12	32.87
3.192	1.33	6085	.2191E-01	.8233E-03	37.14	34.02
3.451	1.42	6153	.2504E-01	.9868E-03	38.52	35.65
3.494	1.45	6210	.1795E-01	.7045E-03	35.49	33.94
3.433	1.51	6243	.2603E-01	.1145E-02	40.40	36.77
4.041	1.59	6747	.2049E-01	.1174E-02	41.44	37.75
4.177	1.64	6792	.2661E-01	.1154E-02	42.44	38.66
4.379	1.71	6467	.2774E-01	.1094E-02	43.17	39.67
4.491	1.76	6496	.3102E-01	.1330E-02	44.35	40.36
4.675	1.84	6551	.3309E-01	.1303E-02	45.41	41.33
4.853	1.91	6631	.3589E-01	.1413E-02	46.56	42.35
5.004	1.97	6667	.4214E-01	.1668E-02	47.64	43.36
5.012	2.17	6711	.8242E-01	.3245E-02	49.71	45.24
5.774	2.27	6751	.5334E-01	.2180E-02	52.12	47.43
5.107	2.36	6791	.5715E-01	.2250E-02	53.74	48.91
6.198	2.44	6811	.4763E-01	.1875E-02	55.17	50.17
6.413	2.52	6861	.7197E-01	.2833E-02	58.50	51.42
6.642	2.61	6836	.6591E-01	.2571E-02	58.33	52.81
6.821	2.66	6921	.7112E-01	.2803E-02	59.46	54.11
7.047	2.73	6946	.1347E+00	.4290E-02	61.44	55.57
7.341	2.83	6971	.1316E+00	.4000E-02	62.95	57.32
7.804	3.01	6936	.1214E+00	.4803E-02	65.13	59.27
7.847	3.15	7016	.1207E+00	.4750E-02	67.31	61.25
8.052	3.17	7031	.1101E+00	.4333E-02	68.99	62.70
8.293	3.26	7041	.2413E+00	.9500E-02	72.71	64.35
8.404	3.34	7048	.2721E+00	.1071E-01	72.67	66.09
8.648	3.43	7054	.2752E+00	.1083E-01	74.25	67.57
8.941	3.57	7055	.5962E+00	.2380E-01	76.42	69.54
9.142	3.61	7064	.4926E+00	.1908E-01	75.08	71.96
9.436	3.71	7067	.2467E+00	.3333E-01	81.49	74.34
9.627	3.73	7069	.9525E+00	.3750E-01	84.15	76.58
9.704	3.85	7070	.1524E+01	.6080E-01	96.15	78.60

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TABLE D2-54

SPECIMEN NUMBER: 125-575			
ALLOY TYPE: 2024-T861			
SPECIMEN ORIENTATION: TRANSVERSE			
CONSTRAINT: UNSTRESS			
ENVIRONMENT: LAB AIR			
TEST TEMPERATURE: 23.23 MM (1.125 IN)			
SPECIMEN THICKNESS: 117.6 MPa (17.02 KSI)			
FREQUENCY: 670 CPS			
CYCLES TO FAILURE: 48.67 MPa SORT(M); 17.01 KSI SORT(M)			
(MIN) 376 CYCLES PRIOR TO FAILURE			

CRACK LENGTH	IN	CYCLES	DELTA(S)/DELTA(M)	MPa / CYCLE	IN / CYCLE	DELTA(STRESS INTENSITY)	MPa SORT(M)	KSI SORT(M)
7.17	.282	1	.1321E-02	.5205E-04	17.49	15.91		
8.12	.321	725	.1499E-02	.5897E-04	18.46	16.40		
8.91	.351	1749	.1810E-02	.7127E-04	19.49	17.70		
9.97	.392	1839	.2162E-02	.8511E-04	20.76	18.53		
11.09	.421	2160	.3623E-02	.1505E-03	21.44	19.51		
12.71	.480	2503	.4487E-02	.1874E-03	22.57	21.54		
13.13	.517	2754	.5699E-02	.2234E-03	23.56	21.44		
14.02	.558	2954	.5794E-02	.2292E-03	24.52	22.32		
15.37	.605	3149	.6751E-02	.2659E-03	25.74	23.17		
16.41	.646	3311	.8296E-02	.3266E-03	26.18	23.82		
17.43	.686	3425	.9223E-02	.3631E-03	27.74	24.81		
18.44	.712	3551	.9714E-02	.3821E-03	27.90	25.70		
19.61	.766	3815	.1347E-01	.5293E-03	29.71	26.13		
21.02	.827	3755	.1411E-01	.5559E-03	29.92	27.14		
22.43	.883	3859	.1577E-01	.6199E-03	30.92	28.14		
24.04	.949	3961	.1477E-01	.7372E-03	32.79	29.20		
25.75	1.015	4141	.2514E-01	.9127E-03	33.47	30.46		
26.14	1.010	4151	.2715E-01	.1.09E-03	34.19	31.75		
27.07	1.064	4224	.3355E-01	.1321E-02	36.14	32.59		
28.38	1.109	4231	.3644E-01	.1421E-02	37.71	33.46		
29.92	1.175	4354	.3644E-01	.1372E-02	38.15	34.72		

TABLE D2-55

SPECIMEN NUMBER: U125-272			
ALLOY TYPE: 2024-T861			
SPECIMEN ORIENTATION: TRANSVERSE			
CONSTRAINT: UNSTRESS			
ENVIRONMENT: LAB AIR			
TEST TEMPERATURE: 23.24 MM (1.125 IN)			
SPECIMEN THICKNESS: 195.9 MPa (28.44 KSI)			
FREQUENCY: 1041 CPS			
CYCLES TO FAILURE: 97.20 MPa SORT(M); 48.45 KSI SORT(M)			
(MIN) 2 CYCLES PRIOR TO FAILURE			

CRACK LENGTH MM	IN	CYCLES	DELTA(S) / DELTA(M) MPa / CYCLE	IN / CYCLE	DELTA(STRESS INTENSITY) MPa SORT(M)	KSI SORT(M)
4.51	.178	1	.9364E-02	.3569E-03	35.44	37.25
5.47	.215	245	.1738E-01	.6844E-03	40.15	34.58
7.71	.303	331	.1611E-01	.7799E-03	42.29	38.47
8.51	.335	710	.2837E-01	.1116E-02	44.58	40.57
9.46	.373	772	.4377E-01	.1736E-02	46.95	42.72
11.17	.437	820	.3705E-01	.1459E-02	48.93	44.53
11.75	.463	859	.5884E-01	.2238E-02	58.46	46.29
12.00	.475	891	.9142E-01	.3599E-02	62.91	48.15
12.47	.491	910	.8637E-01	.3399E-02	64.77	49.84
13.65	.5375	924	.1.044E-01	.4117E-02	67.91	51.88
14.30	.563	952	.1758E-01	.6713E-02	69.19	53.87
15.57	.6134	961	.1407E-01	.6307E-02	61.29	55.77
16.47	.649	974	.1443E-01	.5843E-02	63.42	57.77
17.76	.699	994	.2121E-01	.8352E-02	66.36	60.12
19.75	.778	1003	.2479E-01	.9748E-02	68.56	62.42
21.22	.832	1017	.3552E-01	.1399E-01	70.94	64.55
21.64	.854	1015	.4425E-01	.1742E-01	75.11	68.35
24.11	.948	1030	.8530E-01	.3516E-01	79.22	72.09
25.44	1.001	1033	.1407E-01	.5521E-01	83.54	74.03
26.44	1.041	1037	.2864E-01	.1.049E-01	85.60	81.36

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TABLE D2-56

SPECIMEN NUMBER: 129-114
SPEICIMEN ORIGIN: 2124-T851
CONSTRAINT: LONGITUDINAL
TEST TEMPERATURE: STIFFENED
SPECIMEN THICKNESS: 1.25 IN
MANIPULATION: 3.23 MM (1.270 IN)
FREQUENCY: 110.5 HPA (11.22 KSI)
CYCLES TO FAILURE: 5350 CYCLES
K(MAX): 496 CYCLES PRIOR TO FAILURE: 47.46 MPA SORT(MIN) 63.19 KSI SORT(MIN)

CRACK LENGTH IN	MPA	CYCLES	DELTA (K1)/DELTA (IN) MM/CYCLE	IN/CYCLE	DELTA (STRESS INTENSITY) MPA SORT(MIN)	KSI SORT(MIN)
7.69	1.313	1	.1183E-02	.4659E-04	18.12	14.49
9.71	1.343	867	.1194E-02	.7243E-04	19.03	17.32
11.35	1.368	1217	.1733E-02	.6045E-04	19.94	18.16
12.44	1.411	1870	.1734E-02	.6831E-04	20.48	19.16
13.16	1.447	2347	.2947E-02	.1733E-03	21.43	19.67
14.14	1.490	2755	.3253E-02	.1281E-03	22.67	21.63
15.14	1.519	3115	.3654E-02	.1439E-03	23.58	21.46
16.14	1.560	3241	.4163E-02	.1039E-03	24.44	22.27
17.14	1.612	3757	.3798E-02	.1495E-03	25.17	22.91
18.14	1.632	3701	.5144E-02	.2242E-03	26.77	23.45
19.14	1.659	3835	.4283E-02	.2474E-03	26.44	24.10
20.14	1.712	4146	.5571E-02	.3492E-03	27.34	24.90
21.14	1.749	4199	.5687E-02	.2239E-03	28.50	25.94
22.14	1.820	4721	.1214E-01	.3941E-03	29.88	27.41
23.14	1.874	4745	.1122E-01	.4419E-03	30.41	28.04
24.14	1.965	4814	.9431E-02	.3871E-03	31.93	29.28
25.14	1.111	4959	.1324E-01	.5213E-03	32.97	30.48
26.14	1.154	5141	.1319E-01	.5981E-03	34.18	31.11
27.14	1.143	5213	.1231E-01	.6421E-03	35.35	32.17
28.14	1.221	6317	.1984E-01	.7419E-03	36.33	33.67
29.14	1.252	5397	.1921E-01	.7497E-03	37.35	33.99
30.14	1.328	5674	.2527E-01	.9493E-03	38.51	35.06
31.14	1.404	5114	.2202E-01	.4671E-03	39.71	36.14
32.14	1.476	5613	.3318E-01	.1188E-02	40.74	37.07
33.14	1.517	5644	.3270E-01	.1207E-02	41.89	37.94
34.14	1.597	5731	.4693E-01	.1848E-02	42.84	38.99
35.14	1.682	5777	.2420E-01	.9527E-03	43.78	39.85
36.14	1.718	5814	.3367E-01	.1326E-02	44.57	40.55
37.14	1.782	5863				

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TABLE D2-57

SPECIMEN NUMBER: ALLOY TYPE: SPECIMEN ORIENTATION: CONSTRAINT: ENVIRONMENT: TEST TEMPERATURE: SPECIMEN THICKNESS: NATURAL STRESS: FREQUENCY: CYCLES TO FAILURE: K(MAN) 1 CYCLES PRIOR TO FAILURE:						
125-115 2024-T861 LONGITUDINAL STIFFENED LAP JOINT 3.35 MM (0.132 IN) 195.4 MPA (28.1 KSI) 200 CPS 950 CYCLES NET STRESS GREATER THAN 0.9 FTYI						
CHUCK LENGTH MM IN	CHUCK EN	CYCLES	DELTA(I)/DELTA(I) MM/CYCLE IN/CYCLE	DELTA(II)/DELTA(II) MM/CYCLE IN/CYCLE	DELTA(III)/DELTA(III) MM/CYCLE IN/CYCLE	DELTA(IV)/DELTA(IV) MM/CYCLE IN/CYCLE
9.97	0.392	1	.1221E-01	.4428E-03	37.74	33.71
9.94	0.390	226	.1919E-01	.7995E-03	40.77	37.18
8.15	0.320	752	.2964E-01	.1164E-02	41.37	39.60
9.44	0.371	10	.4283E-01	.1686E-02	45.71	41.40
9.44	0.371	449	.7389E-01	.1333E-02	47.31	43.60
11.75	0.462	502	.4676E-01	.1441E-02	50.15	45.65
11.74	0.461	844	.8347E-01	.2146E-02	52.44	47.74
12.73	0.501	532	.5147E-01	.2020E-02	54.35	49.04
13.54	0.533	815	.7393E-01	.2994E-02	56.63	51.53
14.41	0.568	642	.6146E-01	.2341E-02	58.54	53.38
15.45	0.610	170	.6985E-01	.2711E-02	61.52	55.18
16.35	0.644	196	.8713E-01	.3471E-02	63.52	56.90
17.15	0.675	719	.8917E-01	.3511E-02	64.54	58.43
18.19	0.716	742	.9647E-01	.3794E-02	66.45	60.40
19.10	0.752	757	.1303E+00	.5131E-02	68.71	61.44
19.44	0.766	749	.1419E+00	.5584E-02	70.05	63.75
21.9	0.861	796	.1307E+00	.5501E-02	72.21	65.72
22.1	0.875	733	.1744E+00	.7051E-02	74.41	67.73
23.75	0.937	813	.1771E+00	.6949E-02	76.63	69.74
24.14	0.950	823	.2240E+00	.9011E-02	78.60	71.53
25.17	0.991	832	.1898E+00	.7471E-02	80.94	73.67
26.41	1.043	845	.2347E+00	.9330E-02	83.17	75.67
27.47	1.081	854	.3482E+00	.1574E-01	87.31	79.17
29.81	1.173	864	.4142E+00	.1843E-01	91.41	83.55
F	31.84	876	.4675E+00	.1871E-01	97.65	88.46
F	34.42	891				
F	35.45	916				
F	39.24	916				
F	42.4	926				
F	43.69	931				
F	46.23	936				
F	48.1	941				
F	51.17	948				
F	53.35	949				
F	57.3	952				
F	63.45	954				
F	62.44	955				

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TABLE D2-58

SPECIMEN NUMBER: 125-577
 ALLOY TYPE: 2024-T861
 SPECIMEN ORIENTATION: TRANSVERSE
 CONSTRAINT: STIFFNESS
 TEST ENVIRONMENT: 120 A/D
 TEST TEMPERATURE: 428.0 K
 SPECIMEN THICKNESS: 1.25 MM (1.250 IN)
 MAXIMUM STRESS: 118.6 MPa (17.2 KSI)
 FREQUENCY: 200 Hz
 CYCLES TO FAILURE: 4219 CYCLES
 KINAXI: 502 CYCLES PRIOR TO FAILURE: 41.17 MPa SQRT(IN) 37.41 KSI SQRT(IN)

CRACK LENGTH MM IN	CYCLES 1	DELTA(K)/DELTA(IN) MM/CYCLE IN/CYCLE	DELTA(Stress) MPa SQRT(IN)	INTENSITY KSI SQRT(IN)
4.99	437	.2477E-02	.9556E-04	16.57
9.97	1121	.1941E-02	.7643E-04	17.65
11.47	1234	.2665E-02	.1.49E-01	19.39
11.36	1576	.2447E-02	.1114E-01	19.22
13.13	2010	.3781E-02	.1449E-01	20.16
13.46	2178	.4314E-02	.1698E-01	21.21
14.52	2249	.5489E-02	.2161E-01	21.76
15.36	2447	.5719E-02	.2252E-01	22.35
16.31	2591	.6252E-02	.2462E-01	22.91
17.32	2711	.8117E-02	.3196E-01	23.64
18.13	2811	.6377E-02	.3195E-01	24.40
19.27	2836	.1374E-01	.5411E-01	25.69
20.34	3117	.1359E-01	.5355E-01	26.35
22.34	3137	.1204E-01	.4742E-01	27.09
23.62	3233	.1277E-01	.5003E-01	27.96
25.23	3242	.2304E-01	.1145E-02	31.66
26.91	3372	.2393E-01	.8239E-01	32.79
29.65	3471	.1774E-01	.6985E-01	34.87
31.37	3538	.2537E-01	.9985E-01	35.15
31.59	3545	.2398E-01	.8259E-01	36.11
32.99	3644	.2921E-01	.1153E-02	36.35
34.57	3684	.3943E-01	.1551E-02	37.90
35.59	3717	.3106E-01	.1223E-02	38.72

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SPECIMEN NUMBER: 125-779
SPECIMEN TYPE: 222-7-102
SPECIMEN CONDITION: 222-7-102
CONSTRAINTS: TRANSVERSE
TEST TYPE: STRIP
SPECIMEN THICKNESS: 0.015 IN
PART: UP
PART: DOWN
FREQUENCY: 3.25 PH (1.125 KHZ)
Cycles to failure: 199.8 MPA (28.6 KSI)
Cycles prior to failure: 780 Cycles
INLET STRESS GREATER THAN 780 Cycles

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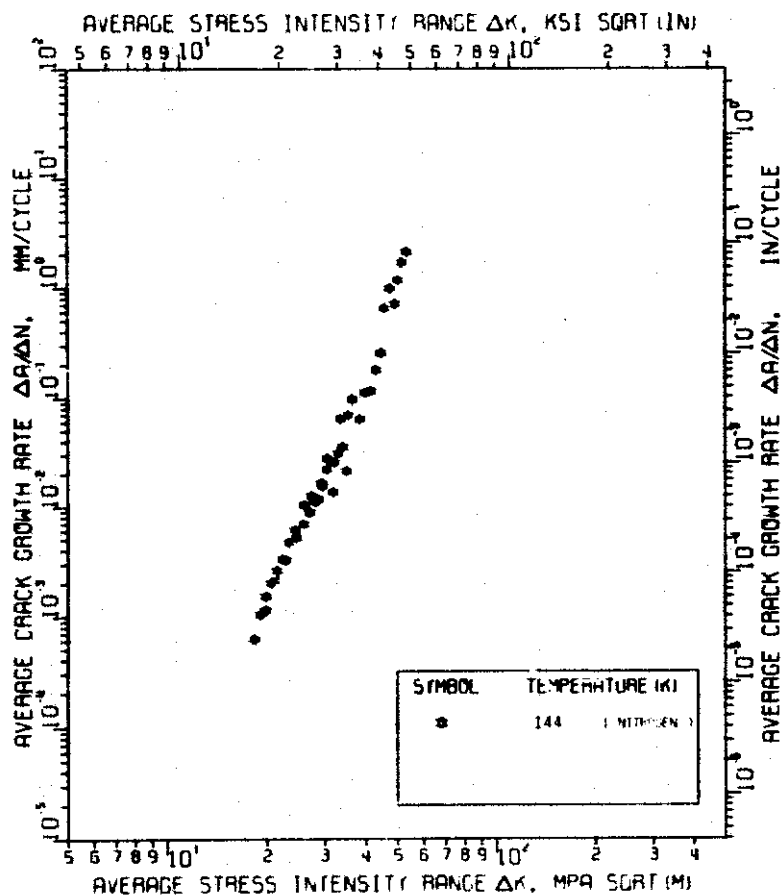
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TABLE D2-61

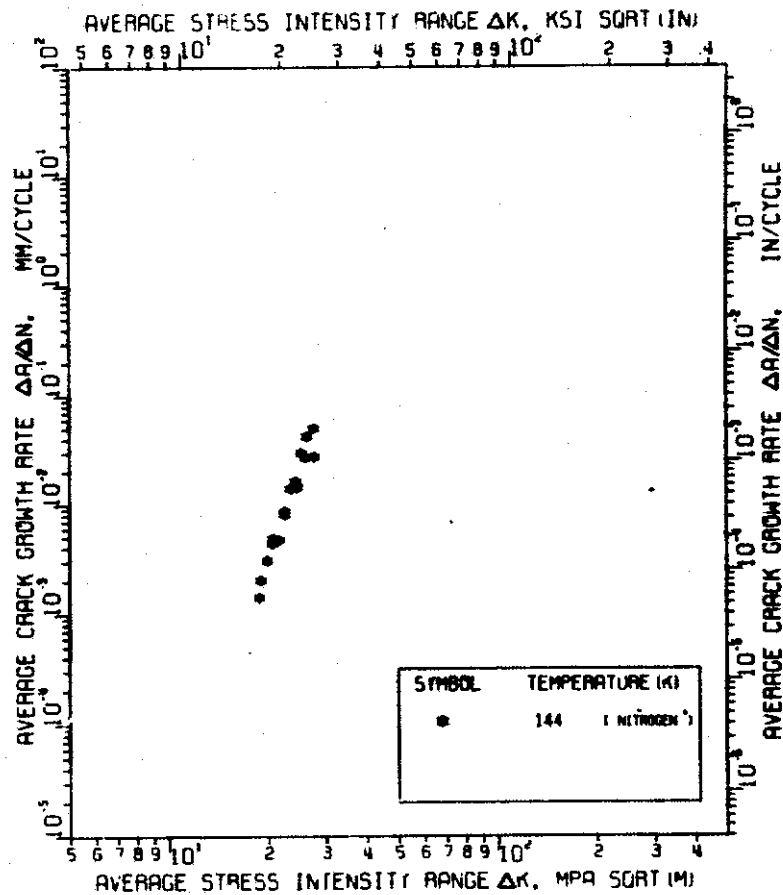
SPECIMEN NUMBER: U125-5117
ALLOY TYPE: 2024-T851
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINT: UNSTIFFENED
TEST TEMPERATURE: 678.0 K
SPECIMEN THICKNESS: 3.25 MM (0.128 IN)
MAXIMUM STRESS: 112.6 MPa (16.2 KSI)
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 5287 CYCLES
K(MAX): 736 CYCLES PRIOR TO FAILURE 42.43 MPa SQRT(IN) 38.93 KSI SQRT(IN)

CRACK LENGTH MM IN	CYCLES I	DELTA(I)/DELTA(IN) MM/CYCLE IN/CYCLE	DELTA STRESS INTENSITY MPa SQRT(IN) KSI SQRT(IN)
8.36 .329			
9.17 .361	561	.1447E-02 .5696E-04	19.73 17.05
10.11 .398	864	.1102E-02 .6179E-04	19.66 17.49
13.43 .425	1305	.1571E-02 .1025E-03	20.48 19.82
12.40 .504	2875	.3975E-02 .1565E-03	23.33 21.23
14.21 .559	2428	.4451E-02 .1752E-03	24.36 21.17
15.19 .598	2640	.4764E-02 .1877E-03	25.21 22.95
16.25 .640	2872	.7691E-02 .3628E-03	25.99 23.65
17.09 .673	2990	.6464E-02 .2545E-03	26.56 24.26
17.95 .707	3114	.7233E-02 .2848E-03	27.26 24.81
18.62 .733	3206	.8593E-02 .3381E-03	27.98 25.46
19.43 .781	3347	.5223E-02 .2056E-03	28.78 26.19
20.76 .817	3525	.1193E-01 .6272E-03	29.97 27.27
23.37 .908	3678	.1450E-01 .5789E-03	31.29 28.48
24.49 .964	3768	.1761E-01 .6934E-03	32.48 29.56
26.50 1.043	3882	.1254E-01 .4446E-03	33.63 30.61
27.90 1.099	3994	.1695E-01 .6573E-03	34.56 31.45
29.20 1.153	4078	.2211E-01 .8785E-03	35.57 32.37
31.80 1.221	4153	.1619E-01 .6375E-03	36.64 33.36
32.56 1.282	4249	.2282E-01 .8848E-03	37.84 34.43
34.76 1.388	4349	.2359E-01 .9288E-03	39.88 35.98
36.40 1.436	4422	.3610E-01 .1508E-02	48.15 38.94
38.19 1.504	4467		

(a) Longitudinal



(b) Transverse



Alloy: 2024-T861

Stress Ratio: .05

Frequency: 200 cpm

Thickness: 3.18 mm (.125 inch)

Constraint: Stiffened

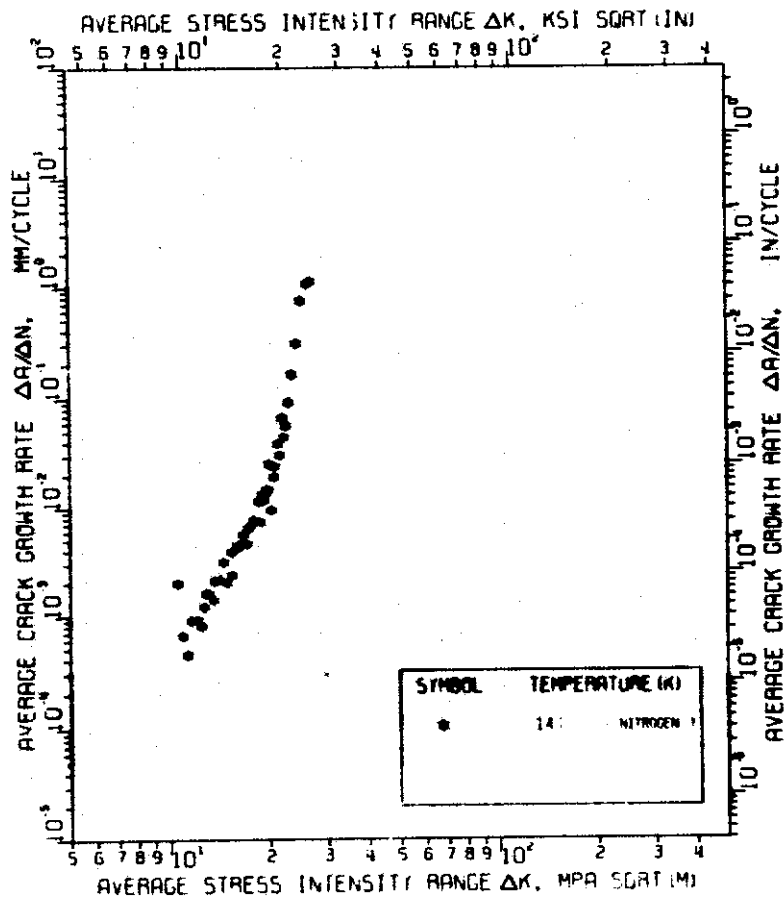
AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

FINAL REPORT

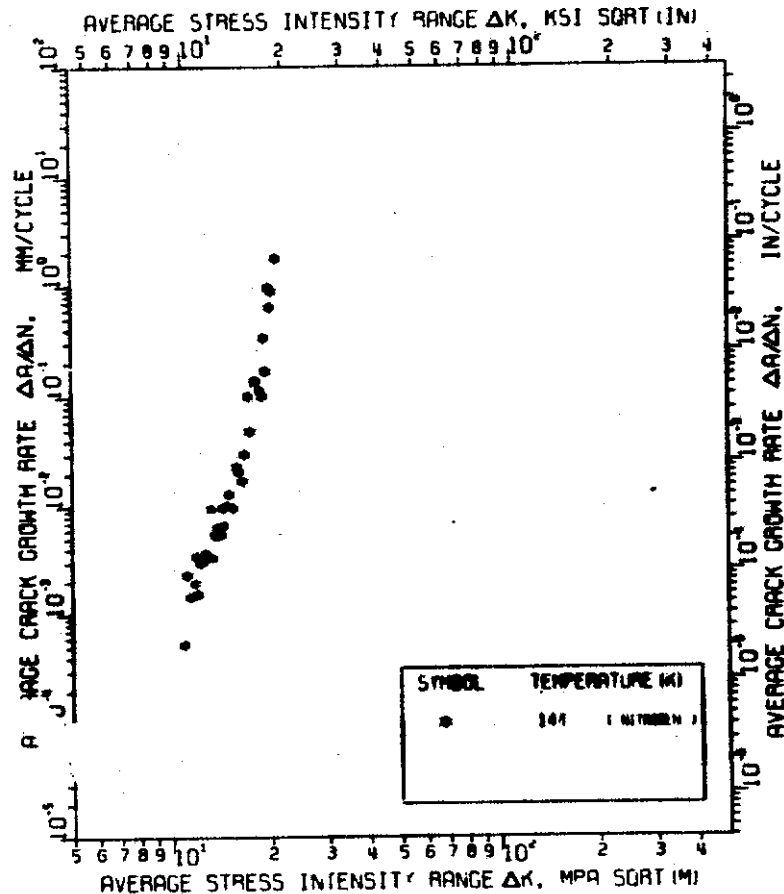
FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T861

DDC E1153
October 1974

(a) Longitudinal



(b) Transverse



Alloy: 2024-T861

Stress Ratio: .50

Frequency: 200 cpm

Thickness: 3.18 mm (.125 inch)

Constraint: Stiffened

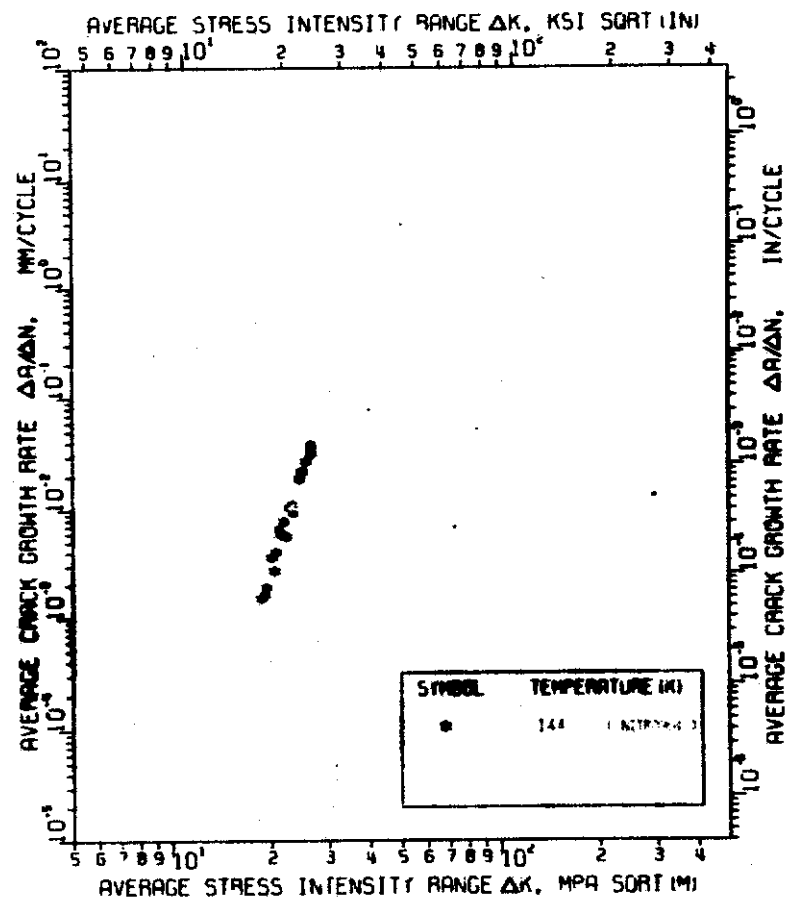
AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

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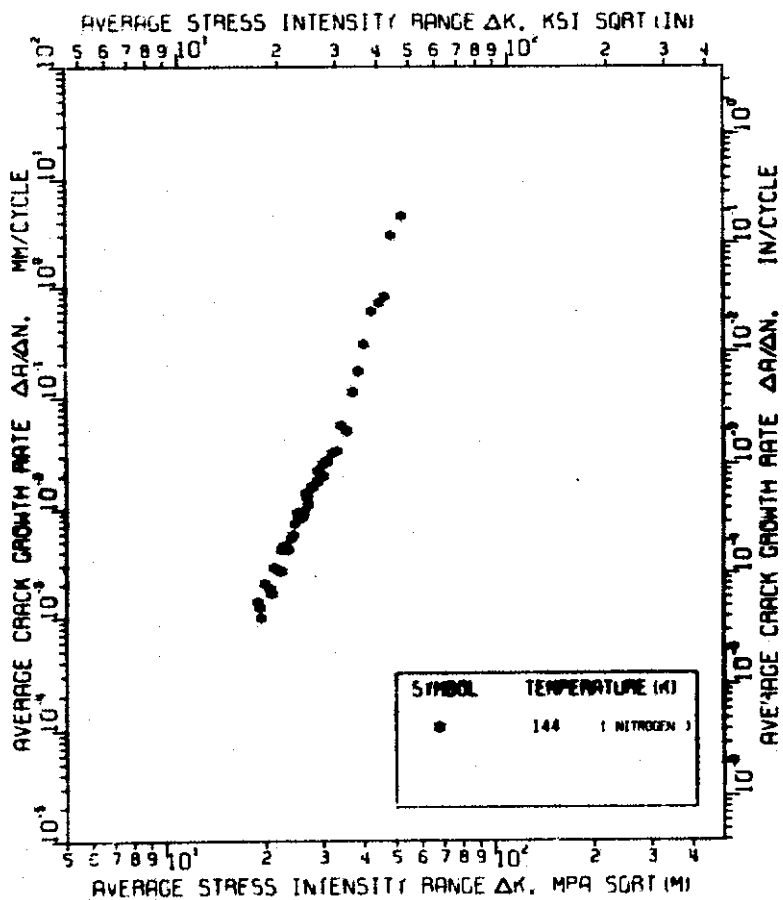
FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T861

MSC E1153
October 1974

(b) Transverse



(a) Longitudinal



Alloy: 2024-T861

Stress Ratio: .05

Frequency: 200 cpm

Thickness: 3.18 mm (.125 inch)

Constraint: Unstiffened

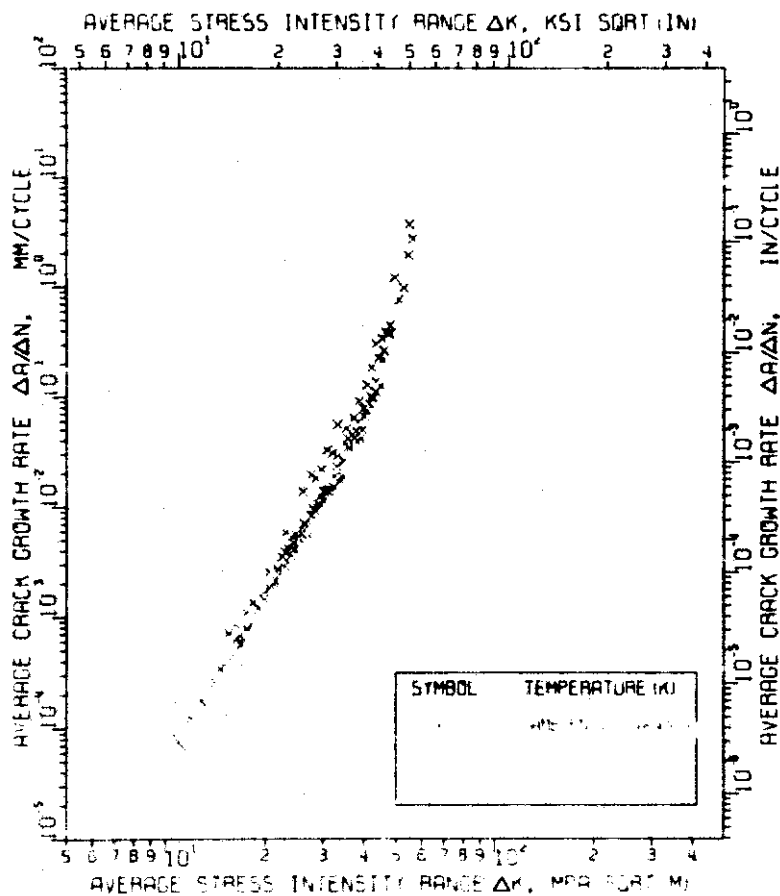
AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

FIGURE D2-3

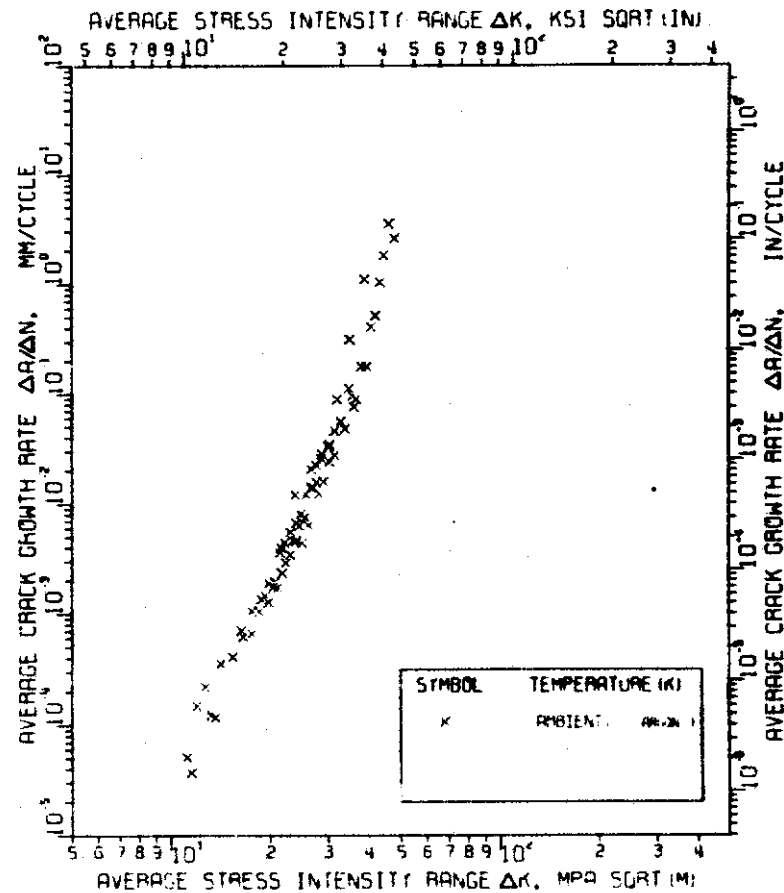
D-117

MCDONNELL DOUGLAS AERONAUTICS COMPANY - EAST

(a) Longitudinal



(b) Transverse



Alloy: 2024-T861

Stress Ratio: .05

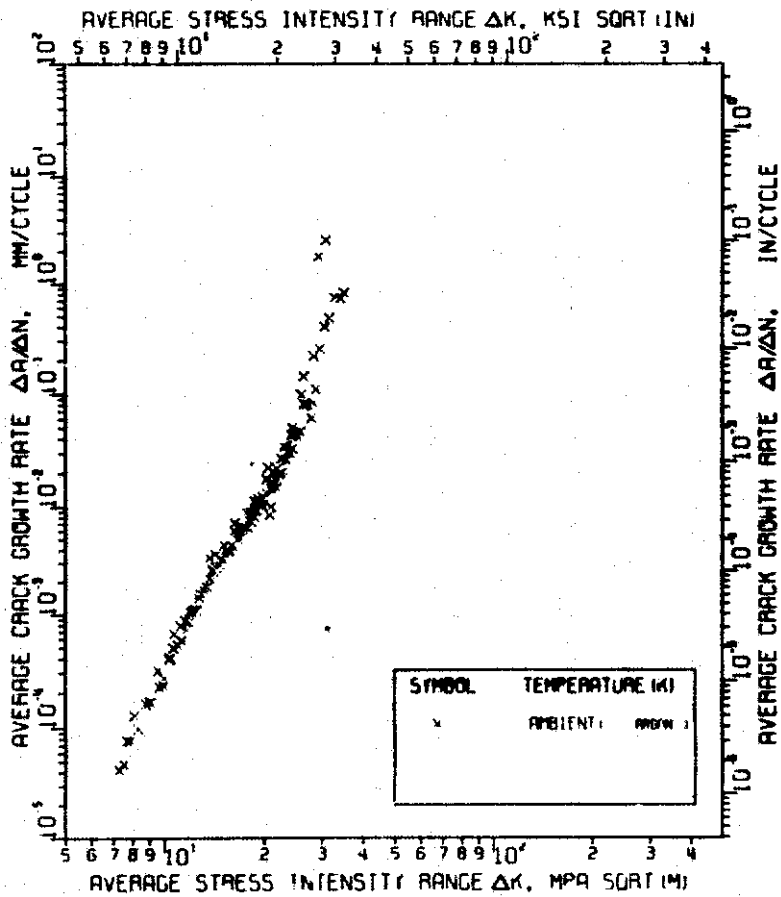
Frequency: 200 cpm

Thickness: 3.18 mm (.125 inch)

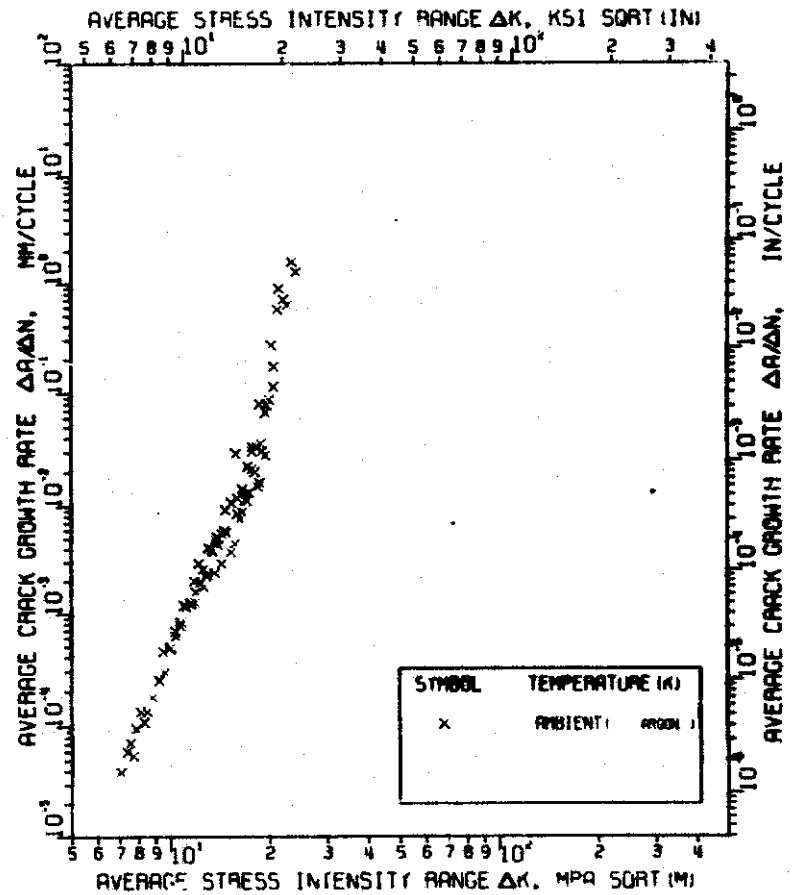
Constraint: Stiffened

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

(a) Longitudinal



(b) Transverse



Alloy: 2024-T861

Stress Ratio: .50

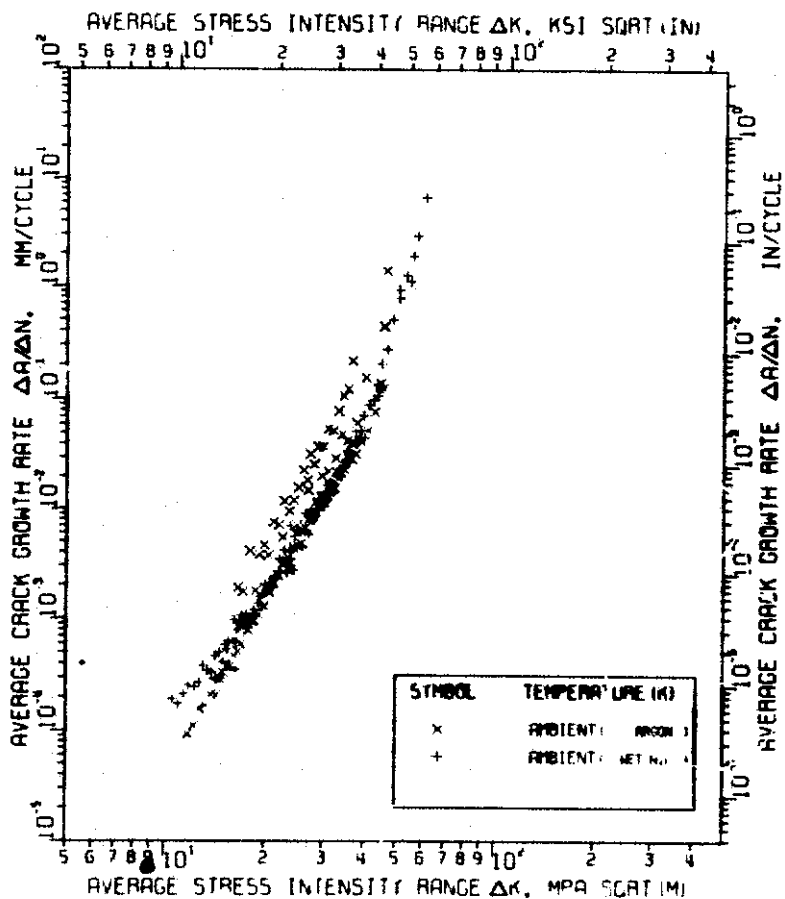
Frequency: 200 cpm

Thickness: 3.18 mm (.125 inch)

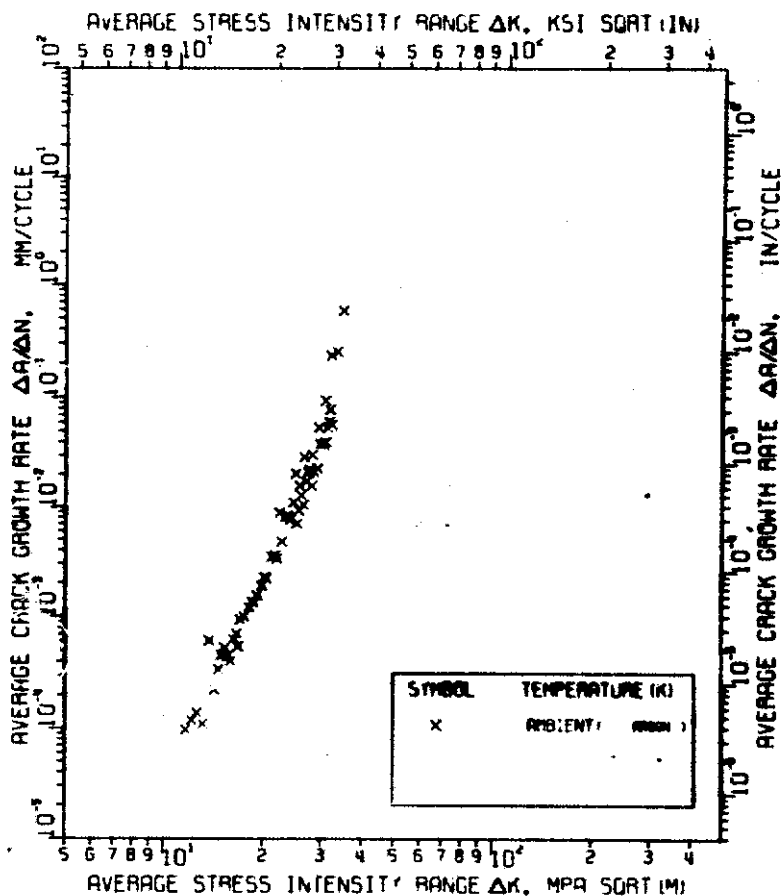
Constraint: Stiffened

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

(a) Longitudinal



(b) Transverse



Alloy: 2024-T861

Stress Ratio: .05

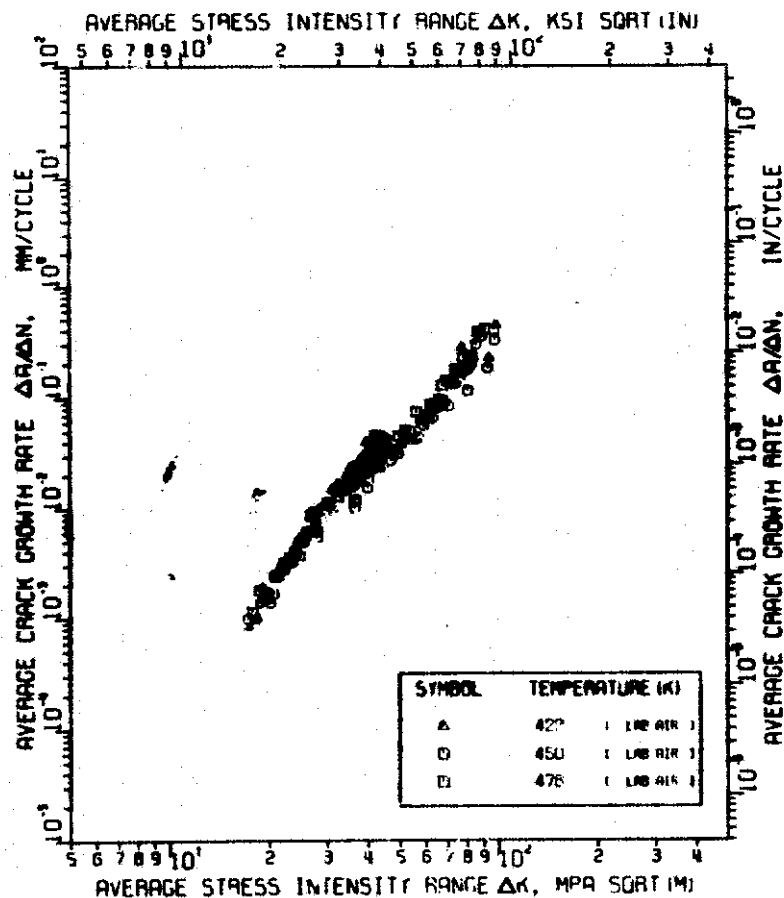
Frequency: 200 cpm

Thickness: 3.18 mm (.125 inch)

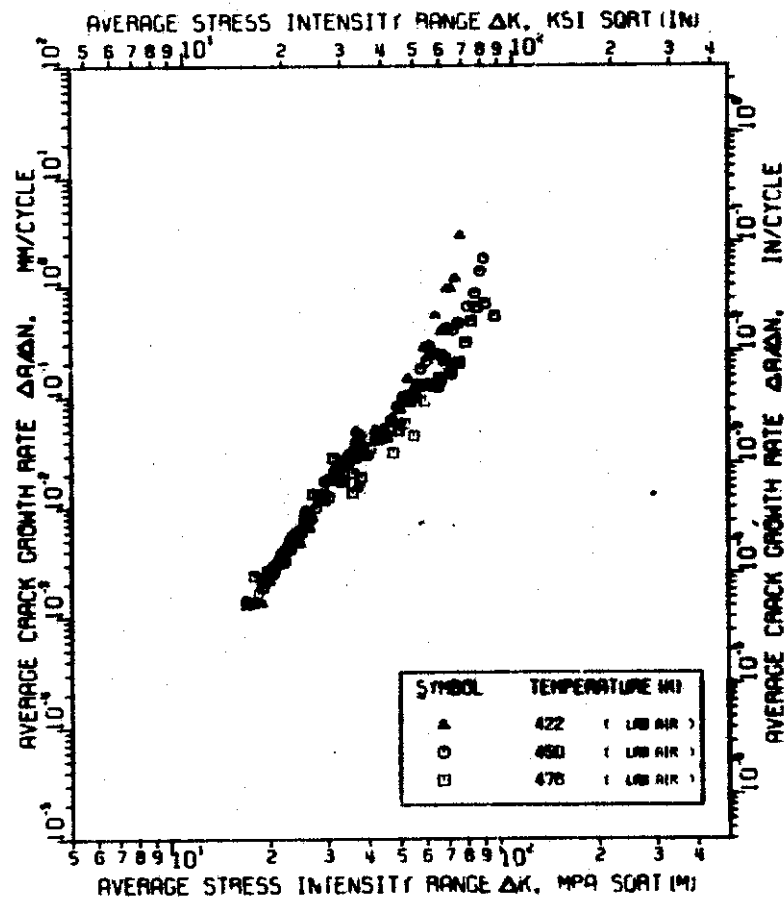
Constraint: Unstiffened

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

(a) Longitudinal



(b) Transverse



Alloy: 2024-T861

Stress Ratio: .05

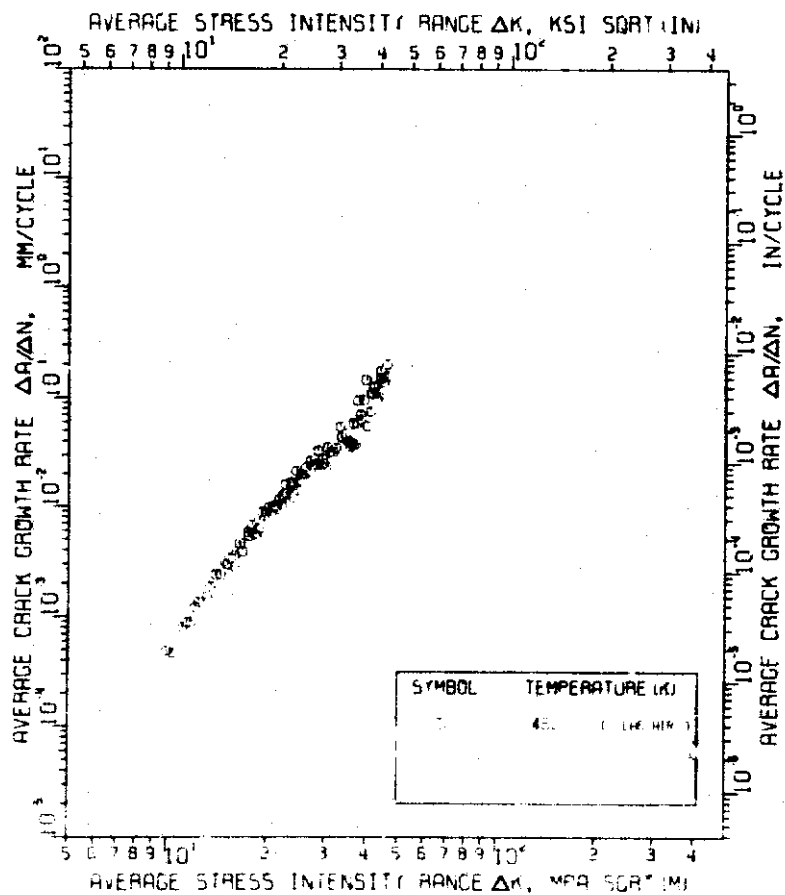
Frequency: 200 cpm

Thickness: 3.18 mm (.125 inch)

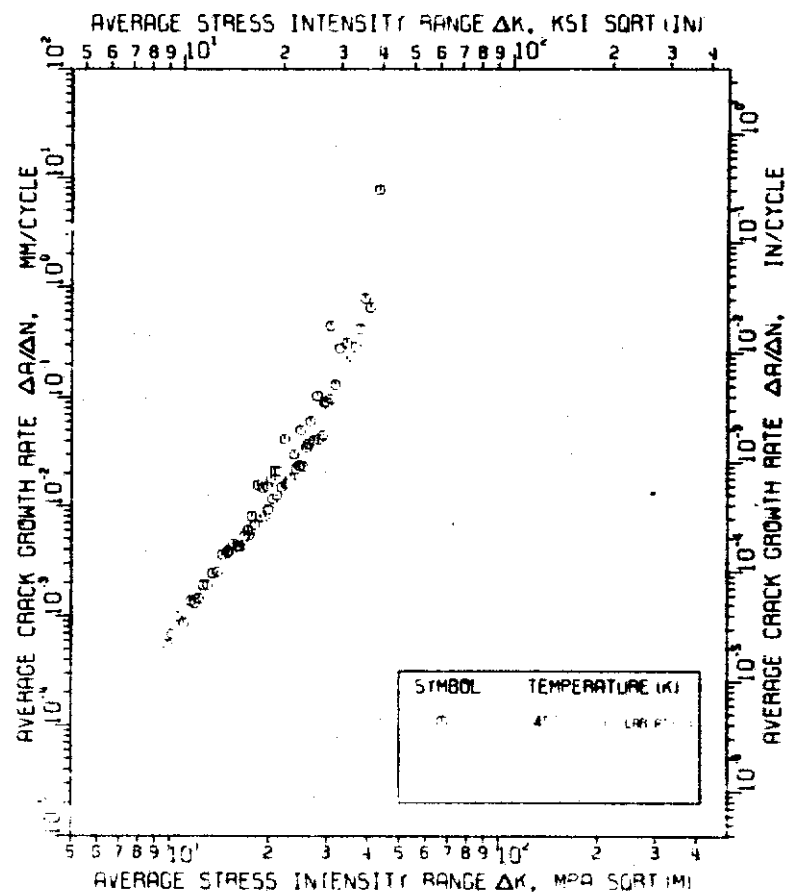
Constraint: Stiffened

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

(a) Longitudinal



(b) Transverse



Alloy: 2024-T861

Stress Ratio: .50

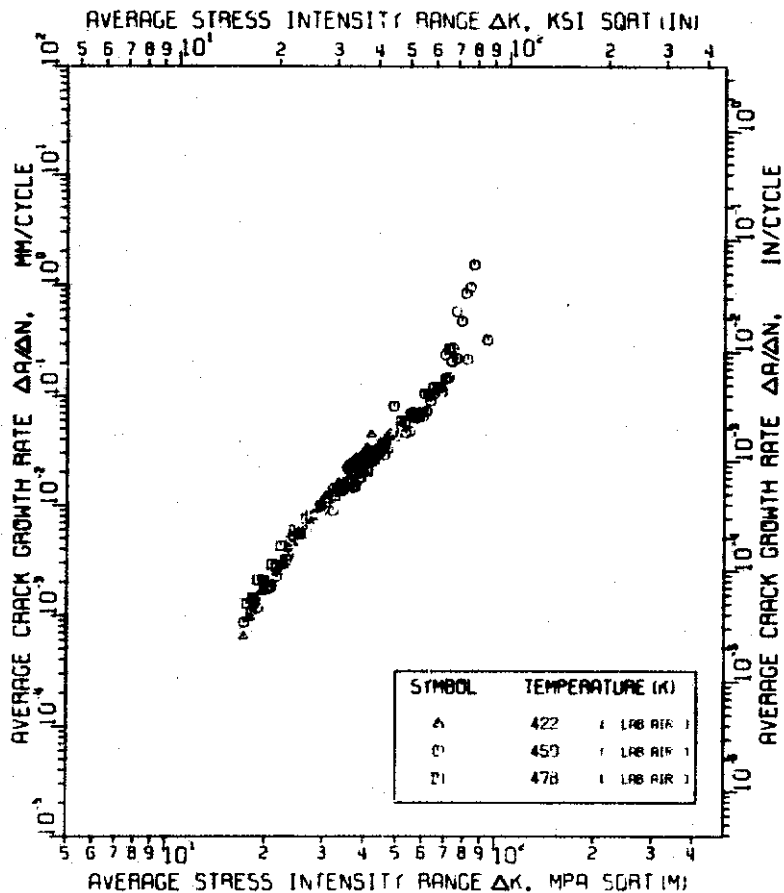
Frequency: 200 cpm

Thickness: 3.18 mm (.125 inch)

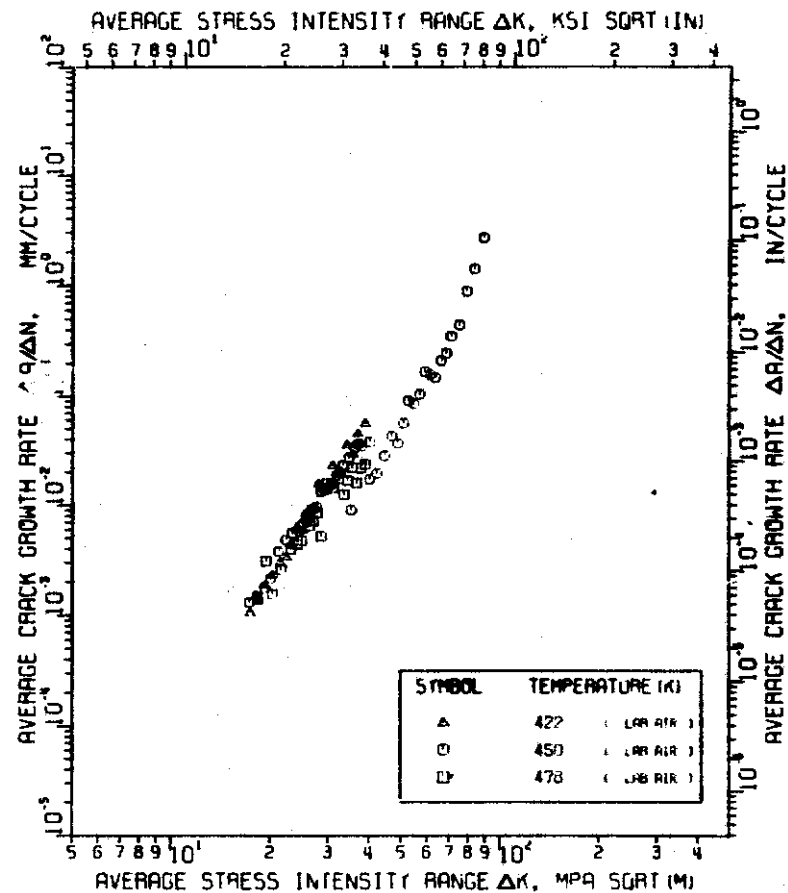
Constraint: Stiffened

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

(a) Longitudinal



(b) Transverse



Alloy: 2024-T861

Stress Ratio: .05

Frequency: 200 cpm

Thickness: 3.18 mm (.125 inch)

Constraint: Unstiffened

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

SECTION D3 - - FLAW GROWTH RATE DATA
FOR 6.35 mm (.250 INCH) THICK 2024-T861

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FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

MDC E1153
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TABLE D3-1. SUMMARY OF SPECIMEN TEST CONDITIONS FOR
200 CPM TESTS OF 6.35 mm (.250 INCH) THICK 2024-T861

<u>Test Temperature (°K)</u>	<u>Stress Ratio</u>	<u>Test Direction</u>	<u>Specimen I.D.</u>	<u>Data Table No.</u>	<u>Figure No.</u>
144 (N ₂)	.05	L	250-1L4	D3-2	D3-1(a)
			250-2L1	D3-3	D3-1(a)
		T	250-1T3	D3-4	D3-1(b)
			250-2T4	D3-5	D3-1(b)
298 (Argon)	.05	L	250-4L3	D3-6	D3-2(a)
			250-3L1	D3-7	D3-2(a)
		T	250-2T1	D3-8	D3-2(b)
			250-2T9	D3-9	D3-2(b)
			250-2T5	D3-10	D3-2(b)
	.50	L	250-3L9	D3-11	D3-3
298 (Wet Air)	.05	L	250-3L3	D3-12	D3-4(a)
			250-1L3	D3-13	D3-4(a)
			250-2L2	D3-14	D3-4(a)
		T	250-2T11	D3-15	D3-4(b)
			250-1T9	D3-16	D3-4(b)
			250-3T2	D3-17	D3-4(b)
422	.05	L	250-1L1	D3-18	D3-5(a)
			250-4L2	D3-19	D3-5(a)
		T	250-1T5	D3-20	D3-6(b)
450	.05	L	250-3L13	D3-21	D3-5(a)
			250-3L5	D3-22	D3-5(a)
		T	250-4T2	D3-23	D3-5(b)
			250-4T3	D3-24	D3-5(b)
478	.05	L	250-3L11	D3-25	D3-5(a)
		T	250-1T7	D3-26	D3-5(b)

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FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

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TABLE D3-2

SPECIMEN NUMBER: 745-114			
ALLOY TYPE: 2024-T861			
SPECIMEN ORIENTATION: LONGITUDINAL			
CONSTRAINT: UNSTRESS			
TEST TEMPERATURE: 144.0 K			
SPECIMEN THICKNESS: 6.27 MM (0.247 IN)			
MAXIMUM STRESS: 114.4 MPa (16.2 KSI)			
P-RATIO: 2.0			
FREQUENCY: 3367 CYCLES			
CYCLES TO FAILURE: 3367			
K(MAN) 42 CYCLES PRIOR TO FAILURE: 32.12 MPa SQRT(IN) (29.23 KSI SQRT(IN))			

CRACK LENGTH	MM	IN	CYCLES	DELTA(A)/DELTA(IN)	DELTA(Stress Intensity)
				MM/CYCLE	MPa SQRT(IN) KSI SQRT(IN)
0.77	.145		1	.956E-03	.976E-04
0.66	.132		719	.1213E-02	.6746E-04
1.23	.433		1259	.1187E-02	.6673E-04
1.00	.429		1924	.1079E-02	.7397E-04
1.54	.494		2244	.2451E-02	.1123E-01
1.27	.483		2514	.4774E-02	.1879E-01
1.20	.523		2719	.1478E-02	.1369E-01
1.16	.554		2967	.1431E-01	.5513E-03
1.14	.590		3042	.9794E-02	.3846E-01
1.76	.621		3111	.1779E-01	.7007E-03
1.42	.646		3134	.1451E-01	.5714E-03
1.93	.666		3179	.1649E-01	.6543E-03
1.43	.686		3231	.2740E-01	.1379E-02
1.33	.722		323E	.3182E-01	.1293E-02
1.44	.746		3271	.4541E-01	.1787E-01
2.03	.808		3295	.6985E-01	.7790E-02
2.13	.836		3335	.4665E-01	.1817E-02
2.91	.863		3323	.1513E+00	.5943E-02
2.49	.893		3324		

TABLE D3-3

SPECIMEN NUMBER: 253-211			
ALLOY TYPE: 2124-T851			
SPECIMEN ORIENTATION: LONGITUDINAL			
CONSTRAINT: UNSTRESS			
TEST TEMPERATURE: 144.0 K			
SPECIMEN THICKNESS: 6.45 MM (0.254 IN)			
MAXIMUM STRESS: 140.3 MPa (20.3 KSI)			
P-RATIO: 2.0			
FREQUENCY: 203 CYCLES			
CYCLES TO FAILURE: 1687			
K(MAN) 1 CYCLES PRIOR TO FAILURE: 41.52 MPa SQRT(IN) (17.13 KSI SQRT(IN))			

CRACK LENGTH			DELTA(A)/DELTA(IN)		DELTA(Stress Intensity)
IN	CYCLES	MM/CYCLE	IN/CYCLE	MPa SQRT(IN)	KSI SQRT(IN)
.154	1	.9296E-03	.7657E-04	18.74	17.05
.198	933	.2113E-02	.8325E-04	20.10	19.24
.205	1139	.2445E-02	.1002E-03	21.12	19.22
.228	1372	.1711E-02	.6717E-04	21.81	19.87
.235	1407	.1471E-01	.5745E-03	22.81	21.76
.271	1529	.1584E-01	.6157E-03	24.29	22.11
.332	1580	.1071E-01	.7365E-03	25.04	23.37
.337	1628	.9228E-01	.7098E-02	27.11	24.67
.374	1646	.1123E+00	.4422E-02	29.81	27.13
.445	1671	.1778E+00	.7008E-02	32.85	29.89
.555	1681	.5183E+00	.2000E-01	34.89	31.75
.615	1684	.6350E+00	.2987E-01	36.57	33.25
.665	1686	.1924E+01	.6005E-01	38.12	34.69
.725	1687				

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FRACTURE MECHANICS DATA FOR
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TABLE D3-4

SPECIMEN NUMBER: 250-173				250-173	
SPECIMEN ORIENTATION: TRANSVERSE				250-173	
TEST ENVIRONMENT: UNSTRESSING				UNSTRESSING	
TEST TEMPERATURE: NITROGEN				NITROGEN	
SPECIMEN THICKNESS: 0.50 IN (12.70 MM)				0.50 IN (12.70 MM)	
MAXIMUM STRESS: 117.2 KSI (811 MPa)				117.2 KSI (811 MPa)	
FREQUENCY: 200 CYCLES				200 CYCLES	
CYCLES TO FAILURE: 2 CYCLES PRIOR TO FAILURE				2 CYCLES PRIOR TO FAILURE	
K(MAX): 33.78 NPA SQRT(IN)				33.78 NPA SQRT(IN)	
				33.74 KSI SQRT(IN)	
CRACK LENGTH IN	MM	CYCLES	DELTA(K)/DELTA(IN) IN/CYCLE	DELTA(STRESS INTENSITY) NPA SQRT(IN)	DELTA(STRESS INTENSITY) KSI SQRT(IN)
9.90	.216	1	.5633E-03	.2210E-04	15.28
6.60	.240	1967	.7939E-03	.3126E-04	15.43
7.39	.291	2954	.1488E-02	.9537E-04	17.47
8.62	.332	3690	.2684E-02	.1029E-03	18.40
9.09	.356	3947	.4133E-02	.1627E-03	18.49
9.96	.377	4861	.3244E-02	.1278E-03	19.57
10.23	.403	4266	.7006E-02	.2780E-03	20.32
11.08	.436	4388	.9840E-02	.3394E-03	21.31
12.34	.486	4515	.2870E-01	.1117E-02	22.25
13.16	.518	4544	.4623E-01	.1823E-02	22.92
13.86	.545	4559	.7019E-01	.2762E-02	23.84
15.33	.603	4583	.8065E-01	.3497E-02	24.63
15.77	.621	4589	.2134E+00	.8400E-02	24.98
16.28	.638	4587	.4647E+00	.2193E-01	25.59
17.29	.681	4989	.3289E+00	.1299E-01	26.65
18.94	.746	4594	.9131E+00	.3595E-01	27.95
20.76	.817	4596	.2318E+01	.9129E-02	28.79
21.23	.836	4598	.1142E+01	.4655E-01	29.37
22.41	.882	4599	.3088E+01	.1214E+00	30.85
25.49	1.134	4600			29.18

TABLE D3-5

SPECIMEN NUMBER: 250-274				250-274	
SPECIMEN ORIENTATION: TRANSVERSE				250-274	
TEST ENVIRONMENT: UNSTRESSING				UNSTRESSING	
TEST TEMPERATURE: NITROGEN				NITROGEN	
SPECIMEN THICKNESS: 0.50 IN (12.70 MM)				0.50 IN (12.70 MM)	
MAXIMUM STRESS: 164.4 KSI (1137 MPa)				164.4 KSI (1137 MPa)	
FREQUENCY: 200 CYCLES				200 CYCLES	
CYCLES TO FAILURE: 3 CYCLES PRIOR TO FAILURE				3 CYCLES PRIOR TO FAILURE	
K(MAX): 30.42 NPA SQRT(IN)				30.42 NPA SQRT(IN)	
				27.68 KSI SQRT(IN)	
CRACK LENGTH IN	MM	CYCLES	DELTA(K)/DELTA(IN) IN/CYCLE	DELTA(STRESS INTENSITY) NPA SQRT(IN)	DELTA(STRESS INTENSITY) KSI SQRT(IN)
4.36	.171	1	.9217E-03	.2851E-04	14.47
4.70	.185	703	.6115E-03	.2437E-04	14.63
5.38	.219	1675	.1429E-02	.7594E-04	16.83
5.95	.234	2014	.1234E-01	.4867E-03	17.43
7.11	.280	2114	.5715E-01	.2344E-02	18.17
9.28	.365	2144	.4491E+00	.1565E-01	27.86
10.78	.424	2147			25.36

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TABLE D3-6

SPECIMEN NUMBER						
SPECIMEN ORIENTATION						
TEST TEMPERATURE						
SPECIMEN THICKNESS						
MAXIMUM						
PRESSURE						
CYCLES TO FAILURE						
K(MAX) 1 CYCLES PRIOR TO FAILURE						
49.89 MPa SQRT(M) 49.46 KSI SQRT(IN)						
CPACK LENGTH	IN	CYCLES	MM/CYCLE	IN/CYCLE	DELTA (STRESS INTENSITY)	DELTA (STRESS INTENSITY)
MM					MPa SQRT(M)	KSI SQRT(IN)
9.07	.357	21631	.3065E-04	.1522E-05	12.38	11.19
9.72	.383	21631	.9368E-04	.3688E-05	12.67	11.53
11.22	.482	26945	.5114E-04	.2014E-04	13.09	11.91
11.64	.439	28594	.1133E-03	.4461E-05	13.48	12.27
11.48	.442	32412	.2990E-03	.1804E-04	13.81	12.57
12.16	.479	19047	.2591E-03	.1020E-04	14.16	12.88
12.54	.498	36974	.2303E-03	.9381E-05	14.45	13.15
13.17	.518	39173	.2799E-03	.1102E-04	14.76	13.43
13.74	.561	41221	.2753E-03	.1084E-04	15.10	13.74
4.41	.587	43652	.1952E-03	.1556E-04	15.47	14.10
15.10	.495	45397	.3971E-03	.1503E-04	15.84	14.42
15.80	.422	47169	.4444E-03	.1744E-04	16.20	14.74
16.46	.648	4827	.6101E-03	.2402E-04	16.55	15.06
17.19	.677	49828	.2784E-03	.1098E-04	16.82	15.31
17.54	.693	51071	.7281E-03	.2846E-04	17.09	15.55
18.27	.719	52081	.8841E-03	.3185E-04	17.43	15.86
18.91	.744	52859	.1120E-02	.4410E-04	18.07	16.45
21.05	.825	54893	.4349E-03	.3303E-04	18.84	17.14
22.19	.874	56169	.1164E-02	.4581E-04	19.67	17.47
24.47	.963	58128	.2238E-02	.9810E-04	20.50	18.65
26.12	1.129	58663	.2158E-02	.8447E-04	21.12	19.72
27.36	1.177	59442	.2331E-02	.9176E-04	21.71	19.78
29.61	1.142	60145	.1779E-02	.1472E-03	22.34	20.37
30.47	1.203	60539	.4597E-02	.1810E-03	23.07	21.99
32.74	1.273	60944	.6072E-02	.1997E-03	23.43	21.78
34.74	1.348	61417	.4431E-02	.2489E-03	24.76	22.53
36.46	1.415	61669	.1079E-01	.4245E-03	25.54	23.24
38.63	1.521	61473	.1321E-01	.6202E-03	26.29	24.92
41.27	1.605	61994	.1619E-01	.6374E-03	26.46	24.54
42.06	1.646	62105	.2163E-01	.9110E-03	27.68	25.19
43.96	1.730	62196	.2527E-01	.9947E-03	28.45	25.47
45.86	1.815	62272	.2777E-01	.1093E-02	29.14	26.56
47.75	1.843	62343	.6565E-01	.1797E-02	29.91	27.21
49.44	1.944	62378	.5637E-01	.2219E-02	31.47	28.44
F	55.67	62447	.8295E-01	.3259E-02	33.05	30.18
F	57.28	62557	.5716E-01	.2253E-02	33.62	31.40
F	58.42	62627	.1812E-01	.1507E-01	34.26	31.18
F	61.32	62532	.1377E-01	.5400E-02	35.19	32.71
F	57.75	62557	.1016E-01	.6033E-02	36.35	33.18
F	54.77	62567	.2044E-01	.8124E-02	36.93	33.61
F	56.42	62575	.3175E-01	.1257E-01	37.77	34.14
F	54.33	62581	.6012E-01	.2375E-01	38.71	35.23
F	71.74	62595	.7422E-01	.7030E-01	40.00	36.80
F	73.79	62589	.7625E-01	.7070E-01	41.10	37.41
F	75.71	62591	.1441E-01	.7253E-01	42.41	38.50
F	74.09	62591	.2413E-01	.4900E-01	44.00	40.24
F	71.41	62596	.1905E-01	.7537E-01	45.14	41.12
F	43.31	62595	.2921E-01	.1152E-01	46.55	42.16
F	44.23	62596				

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TABLE D3-7

SPECIMEN NUMBER:		25J-361	
ALLOY TYPE:		2024-T861	
SPECIMEN ORIENTATION:		LONGITUDINAL	
CONSTRAINTS:		UNSTIFFENED	
ENVIRONMENT:		AIR	
TEST TEMPERATURE:		70.0 K	
SPECIMEN THICKNESS:		6.63 MM (0.261 IN)	
MAXIMUM STRESS:		276.5 MPA (40.0 KSI)	
R-RATIO:		0.25	
CYCLES TO FAILURE:		184 CYCLES	
K(MAX)		25.23 MPA SQRT(IN) (22.47 KSI SQRT(IN))	
CRACK LENGTH		MM	
IN		IN	
3.41		0.134	
3.97		0.156	
CYCLES		1	
MM/CYCLE		0.5626E-02	
IN/CYCLE		0.2215E-03	
DELTA (K) / DELTA (IN)		23.77	
DELTA (K) / DELTA (IN)		71.0	

TABLE D3-8

SPECIMEN NUMBER:		25J-371	
ALLOY TYPE:		2024-T861	
SPECIMEN ORIENTATION:		LONGITUDINAL	
CONSTRAINTS:		UNSTIFFENED	
ENVIRONMENT:		AIR	
TEST TEMPERATURE:		70.0 K	
SPECIMEN THICKNESS:		6.63 MM (0.261 IN)	
MAXIMUM STRESS:		276.5 MPA (40.0 KSI)	
R-RATIO:		0.25	
CYCLES TO FAILURE:		4449 CYCLES	
K(MAX)		27.15 MPA SQRT(IN) (24.71 KSI SQRT(IN))	
CRACK LENGTH		MM	
IN		IN	
4.63		0.182	
9.31		0.366	
9.92		0.391	
10.62		0.419	
11.29		0.445	
11.90		0.468	
12.76		0.502	
13.21		0.520	
13.95		0.549	
14.72		0.583	
15.29		0.602	
15.71		0.618	
16.51		0.650	
17.10		0.673	
17.85		0.703	
18.74		0.738	
20.32		0.800	
21.02		0.829	
21.67		0.852	
25.90		1.019	
27.21		1.071	
28.66		1.128	
30.79		1.212	
32.52		1.280	
34.43		1.356	
36.37		1.432	
38.82		1.520	
CYCLES		1	
MM/CYCLE		0.1791E-03	
IN/CYCLE		0.709E-05	
DELTA (K) / DELTA (IN)		11.87	
DELTA (K) / DELTA (IN)		13.80	
DELTA (K) / DELTA (IN)		12.37	
DELTA (K) / DELTA (IN)		11.77	
DELTA (K) / DELTA (IN)		12.75	
DELTA (K) / DELTA (IN)		11.60	
DELTA (K) / DELTA (IN)		13.17	
DELTA (K) / DELTA (IN)		11.99	
DELTA (K) / DELTA (IN)		11.45	
DELTA (K) / DELTA (IN)		12.73	
DELTA (K) / DELTA (IN)		13.98	
DELTA (K) / DELTA (IN)		12.72	
DELTA (K) / DELTA (IN)		14.76	
DELTA (K) / DELTA (IN)		13.76	
DELTA (K) / DELTA (IN)		14.60	
DELTA (K) / DELTA (IN)		13.37	
DELTA (K) / DELTA (IN)		14.80	
DELTA (K) / DELTA (IN)		15.17	
DELTA (K) / DELTA (IN)		13.74	
DELTA (K) / DELTA (IN)		15.46	
DELTA (K) / DELTA (IN)		14.07	
DELTA (K) / DELTA (IN)		15.72	
DELTA (K) / DELTA (IN)		14.30	
DELTA (K) / DELTA (IN)		16.07	
DELTA (K) / DELTA (IN)		14.50	
DELTA (K) / DELTA (IN)		16.38	
DELTA (K) / DELTA (IN)		14.91	
DELTA (K) / DELTA (IN)		16.77	
DELTA (K) / DELTA (IN)		15.21	
DELTA (K) / DELTA (IN)		17.17	
DELTA (K) / DELTA (IN)		15.56	
DELTA (K) / DELTA (IN)		16.12	
DELTA (K) / DELTA (IN)		17.71	
DELTA (K) / DELTA (IN)		16.12	
DELTA (K) / DELTA (IN)		18.47	
DELTA (K) / DELTA (IN)		16.77	
DELTA (K) / DELTA (IN)		19.14	
DELTA (K) / DELTA (IN)		17.42	
DELTA (K) / DELTA (IN)		20.04	
DELTA (K) / DELTA (IN)		15.24	
DELTA (K) / DELTA (IN)		20.46	
DELTA (K) / DELTA (IN)		18.97	
DELTA (K) / DELTA (IN)		21.42	
DELTA (K) / DELTA (IN)		19.50	
DELTA (K) / DELTA (IN)		22.17	
DELTA (K) / DELTA (IN)		20.17	
DELTA (K) / DELTA (IN)		22.95	
DELTA (K) / DELTA (IN)		20.09	
DELTA (K) / DELTA (IN)		23.64	
DELTA (K) / DELTA (IN)		21.45	
DELTA (K) / DELTA (IN)		24.45	
DELTA (K) / DELTA (IN)		22.25	
DELTA (K) / DELTA (IN)		25.31	
DELTA (K) / DELTA (IN)		23.34	

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TABLE D3-9

SPECIMEN NUMBER: 252-275
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINT: UNSTRESSING
ENVIRONMENT: AIR
TEST TEMPERATURE: 299.8 K
SPECIMEN THICKNESS: 6.14 MM (0.241 IN)
MAXIMUM STRESS: 118.5 MPA (17.1 KSI)
FREQUENCY: 280 CPW
CYCLES TO FAILURE: 17391 CYCLES
K(MAX): 157 CYCLES PRIOR TO FAILURE 23.81 MPA SORT(M) 21.57 KSI SORT(M)

CRACK LENGTH MM IN	CYCLES	DELTA(A)/DELTA(M) MM/CYCLE IN/CYCLE	DELTA(Stress Intensity) MPa SORT(M) KSI SORT(M)
3.71	.196	1	12.81
4.52	.178	8169	12.73
5.29	.188	12814	13.62
5.92	.233	12712	14.43
6.67	.262	14072	15.25
7.36	.298	19983	16.21
8.49	.334	18111	17.11
9.16	.361	16477	17.74
9.81	.386	16723	18.40
10.59	.417	16945	19.00
11.14	.439	17046	19.54
11.81	.465	17167	20.20
12.71	.503	17236	

TABLE D3-10

SPECIMEN NUMBER: 252-275
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINT: UNSTRESSING
ENVIRONMENT: AIR
TEST TEMPERATURE: 299.8 K
SPECIMEN THICKNESS: 6.14 MM (0.241 IN)
MAXIMUM STRESS: 198.6 MPA (28.4 KSI)
FREQUENCY: 280 CPW
CYCLES TO FAILURE: 197 CYCLES
K(MAX): 49 CYCLES PRIOR TO FAILURE 25.37 MPA SORT(M) 21.77 KSI SORT(M)

CRACK LENGTH MM IN	CYCLES	DELTA(A)/DELTA(M) MM/CYCLE IN/CYCLE	DELTA(Stress Intensity) MPa SORT(M) KSI SORT(M)
3.73	.196	1	21.77
4.42	.173	147	19.74

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TABLE D3-11

SPECIMEN NUMBER						
SPEECH TYPE						
SPECIMEN CIRCUMFERENCE						
COATING						
ENVIRONMENT						
TEST TEMPERATURE						
SPECIMEN THICKNESS						
MAXIMUM STRESS						
FACILITY						
CYCLES TO FAILURE						
MINIMUM 2 CYCLES FACTOR TO FAILURE						
42.82 MPA SORTIM31 12.97 MPA SORTIM31						
212-T861						
2124-T851						
LONGITUDINAL						
UNSTIFFENED						
ARROW						
360°						
5-22 PM 1.2450 IN						
112.6 MPA 117.2 MPA						
280 CM						
16086 CYCLES						
DELTA (STRESS INTENSITY)						
MPA SORTIM31 KSI SORTIM31						
CRACK LENGTH	IN	CYCLES	DELTA (AI)/DELTA (AK)	DELTA (AI)/DELTA (AK)	DELTA (STRESS INTENSITY)	DELTA (STRESS INTENSITY)
MM			MM/CYCLE	IN/CYCLE	MPA SORTIM31	KSI SORTIM31
5.72	.147	1	.1713E-01	.6822E-05	8.77	6.13
6.44	.172	4347	.2567E-03	.9878E-06	7.35	6.69
7.70	.218	7676	.3783E-03	.1496E-06	7.92	7.21
8.75	.258	9643	.4448E-03	.1751E-06	8.35	7.60
9.56	.258	10744	.6574E-03	.2598E-06	8.71	7.93
10.14	.291	11177	.6923E-03	.2724E-06	9.19	8.27
10.74	.315	17716	.9633E-03	.3793E-06	9.42	8.57
11.75	.315	13134	.1442E-02	.6102E-06	9.76	8.86
11.76	.348	13591	.1338E-02	.5148E-06	10.10	9.19
12.54	.376	11131	.1633E-02	.6416E-06	10.47	9.52
12.18	.401	14523	.2103E-02	.8278E-06	10.94	9.86
12.15	.431	14816	.3507E-02	.1381E-05	11.24	10.26
11.17	.469	14153	.4304E-02	.1696E-05	11.77	10.67
12.75	.512	15254	.5774E-02	.2273E-05	12.11	11.02
13.55	.536	15495	.1843E-02	.7244E-06	12.38	11.25
13.44	.545	15451	.1825E-01	.7147E-05	12.77	11.62
14.34	.604	15734	.1291E-01	.5477E-05	13.30	12.11
14.75	.640	15739	.2132E-01	.8000E-05	13.73	12.49
17.12	.642	14452	.2124E-01	.8352E-05	14.18	12.90
14.47	.705	15013	.3625E-01	.1348E-02	14.62	13.31
14.12	.744	15015	.3757E-01	.1479E-02	14.98	13.63
21.22	.796	15054	.4204E-01	.1655E-02	15.28	13.90
21.17	.826	15073	.3196E-01	.1177E-02	15.51	14.20
21.25	.844	16002				
22.31	.912	16013	.7395E-01	.2912E-02	15.96	14.53
23.79	.937	16027	.6298E-01	.2479E-02	16.11	14.84
24.47	.975	16046	.5695E-01	.2242E-02	16.67	15.17
24.41	.955	16054	.1605E-01	.6333E-02	17.21	15.66
27.72	1.031	16067	.1924E-01	.4033E-02	17.72	16.13
24.47	1.054	16074	.2437E-01	.9543E-02	18.18	16.54
25.14	1.014	16076	.7183E-01	.2749E-01	18.72	17.03
31.62	1.245	16077	.7734E-01	.3045E-01	19.39	17.37
33.56	1.321	16083	.6473E-01	.2648E-01	19.55	17.79
35.14	1.392	16082	.6441E-01	.3528E-01	20.18	18.36
46.25	1.427	16083	.9842E-01	.3550E-01	20.62	18.77
34.16	1.504	16084	.1647E-01	.7645E-01	21.09	19.28

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TABLE D3-12

SPECIMEN NUMBER: 200-317 ALLOY TYPE: 2124-T851 SPECIMEN ORIENTATION: LONGITUDINAL CONSTRAINT: UNSTIFFENED ENVIRONMENT: NET 810 TEST TEMPERATURE: 289.0 K SPECIMEN THICKNESS: 6.15 MM (0.242 IN) MAXIMUM STRESS: 75.2 MPA (10.9 KSI) FREQUENCY: 200 CAH CYCLES TO FAILURE: 46981 CYCLES K(MAX): 842 CYCLES PRIOR TO FAILURE: 14.45 MPA SQRT(IN) (13.15 KSI SQRT(IN))						
CRACK LENGTH MM IN		CYCLES	DELTA(K)/DELTA(IN) MM/CYCLE IN/CYCLE	DELTA(STRESS INTENSITY) MPA SQRT(IN) KSI SQRT(IN)		
3.58	.141	1				
4.47	.172	9273	.8437E-04 .3322E-05	7.90	7.26	
4.96	.195	14837	.1038E-03 .4086E-05	8.65	7.87	
5.79	.228	21637	.1249E-03 .4917E-05	9.29	8.65	
6.35	.250	25353	.1912E-03 .5952E-05	9.87	8.98	
7.00	.276	28049	.1029E-03 .7199E-05	10.35	9.42	
7.71	.304	32704	.1937E-03 .7626E-05	10.87	9.89	
8.32	.327	35616	.1790E-03 .7837E-05	11.35	10.23	
8.97	.353	38237	.2913E-03 .9882E-05	11.79	10.73	
9.63	.379	40232	.3116E-03 .1227E-04	12.23	11.13	
10.35	.407	42371	.3950E-03 .1398E-04	12.68	11.54	
10.99	.433	44391	.3287E-03 .1263E-04	13.11	11.93	
11.68	.460	46141	.3895E-03 .1534E-04	13.52	12.30	

TABLE D3-13

SPECIMEN NUMBER: 0-113 ALLOY TYPE: 2024-T861 SPECIMEN ORIENTATION: LONGITUDINAL CONSTRAINT: UNSTIFFENED ENVIRONMENT: NET 810 TEST TEMPERATURE: 289.0 K SPECIMEN THICKNESS: 6.48 MM (0.255 IN) MAXIMUM STRESS: 111.6 MPA (16.2 KSI) FREQUENCY: 200 CAH CYCLES TO FAILURE: 18993 CYCLES K(MAX): 544 CYCLES PRIOR TO FAILURE: 25.22 MPA SQRT(IN) (22.95 KSI SQRT(IN))						
CRACK LENGTH MM IN		CYCLES	DELTA(K)/DELTA(IN) MM/CYCLE IN/CYCLE	DELTA(STRESS INTENSITY) MPA SQRT(IN) KSI SQRT(IN)		
3.69	.145	1				
4.24	.167	2883	.2682E-03 .1056E-04	12.58	11.45	
5.13	.194	3839	.4539E-03 .1787E-04	13.61	12.38	
5.67	.223	4498	.5405E-03 .2128E-04	14.62	13.30	
6.23	.245	6042	.5328E-03 .2098E-04	15.42	14.03	
7.04	.277	6435	.9073E-03 .3572E-04	16.20	14.82	
7.64	.301	7624	.8742E-03 .3442E-04	17.13	15.59	
8.32	.329	8197	.1187E-02 .4675E-04	17.87	16.26	
8.92	.351	8663	.1292E-02 .5086E-04	18.98	16.31	
9.79	.385	9161	.1717E-02 .6817E-04	19.36	17.62	
10.39	.409	9451	.2004E-02 .8197E-04	20.11	18.30	
11.03	.434	9695	.2618E-02 .1031E-03	20.73	18.87	
11.59	.456	9854	.3415E-02 .1345E-03	21.71	19.39	
12.34	.484	10095	.3175E-02 .1250E-03	21.93	19.96	
12.99	.511	11225	.4492E-02 .1965E-03	22.57	21.54	
13.66	.538	12754	.5023E-02 .1977E-03	23.16	21.38	
14.23	.561	14039	.7118E-02 .2892E-03	23.71	21.57	

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TABLE D3-14

SPECIMEN NUMBER: 253-212		ALLOY TYPE: 2024-T861		SPECIMEN ORIENTATION: LONGITUDINAL	
CONSTRAINT: UNSTRESSING		ENVIRONMENT: NET AIR		TEST TEMPERATURE: 288.8 K	
SPECIMEN THICKNESS: 6.57 MM (0.261 IN)		MAXIMUM STRESS: 225.4 MPA (32.7 KSI)		R-RATIO: 20	
CYCLES TO FAILURE: 64 CYCLES PRIOR TO FAILURE		FREQUENCY: 25.72 HPA SQRT(IN)		DELTA (STRESS INTENSITY) MPA SQRT(IN): 23.56	
K(MAX): 64 CYCLES PRIOR TO FAILURE		DELTA (STRESS INTENSITY) KSI SQRT(IN): 21.43			
CRACK LENGTH MM: 1.55	IN: .140	CYCLES: 1	DELTA (A)/DELTA (IN) MM/CYCLE: .4407E-02	IN/CYCLE: .1375E-01	
CRACK LENGTH MM: 4.14	IN: .161	CYCLES: 135			

TABLE D3-15

SPECIMEN NUMBER: 253-211		ALLOY TYPE: 2024-T861		SPECIMEN ORIENTATION: LONGITUDINAL	
CONSTRAINT: UNSTRESSING		ENVIRONMENT: NET AIR		TEST TEMPERATURE: 288.8 K	
SPECIMEN THICKNESS: 6.75 MM (0.267 IN)		MAXIMUM STRESS: 74.5 MPA (11.8 KSI)		R-RATIO: 20	
CYCLES TO FAILURE: 2 CYCLES PRIOR TO FAILURE		FREQUENCY: 30.55 HPA SQRT(IN)		DELTA (STRESS INTENSITY) MPA SQRT(IN): 27.10	
K(MAX): 2 CYCLES PRIOR TO FAILURE		DELTA (STRESS INTENSITY) KSI SQRT(IN): 21.43			
CRACK LENGTH MM: 3.45	IN: .146	CYCLES: 1	DELTA (A)/DELTA (IN) MM/CYCLE: .7514E-04	IN/CYCLE: .2948E-05	
CRACK LENGTH MM: 4.35	IN: .171	CYCLES: 9267	.1073E-03	.4235E-05	7.47
CRACK LENGTH MM: 5.11	IN: .201	CYCLES: 18392	.1157E-03	.4557E-05	7.41
CRACK LENGTH MM: 5.57	IN: .219	CYCLES: 20731	.1164E-03	.4645E-05	7.46
CRACK LENGTH MM: 6.27	IN: .247	CYCLES: 24623	.1202E-03	.4719E-05	7.49
CRACK LENGTH MM: 6.86	IN: .270	CYCLES: 27856	.1234E-03	.4841E-05	7.54
CRACK LENGTH MM: 7.52	IN: .296	CYCLES: 31664	.1257E-03	.4924E-05	7.57
CRACK LENGTH MM: 8.11	IN: .319	CYCLES: 34147	.1281E-03	.5043E-05	7.61
CRACK LENGTH MM: 8.46	IN: .348	CYCLES: 37354	.1291E-03	.5134E-05	7.63
CRACK LENGTH MM: 9.46	IN: .372	CYCLES: 41321	.1307E-03	.5255E-05	7.67
CRACK LENGTH MM: 10.33	IN: .399	CYCLES: 42462	.1344E-03	.5490E-05	7.68
CRACK LENGTH MM: 11.72	IN: .421	CYCLES: 44454	.1379E-03	.5672E-05	7.70
CRACK LENGTH MM: 11.45	IN: .451	CYCLES: 46139	.1426E-03	.5829E-05	7.71
CRACK LENGTH MM: 12.17	IN: .471	CYCLES: 47324	.1471E-03	.6024E-05	7.73
CRACK LENGTH MM: 12.86	IN: .506	CYCLES: 48241	.1524E-03	.6240E-05	7.74
CRACK LENGTH MM: 13.41	IN: .524	CYCLES: 49254	.1524E-03	.6240E-05	7.74
CRACK LENGTH MM: 14.06	IN: .553	CYCLES: 50651	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 14.44	IN: .574	CYCLES: 50841	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 15.44	IN: .612	CYCLES: 51743	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 16.31	IN: .642	CYCLES: 52224	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 16.93	IN: .666	CYCLES: 52744	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 17.70	IN: .707	CYCLES: 53145	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 18.39	IN: .724	CYCLES: 53838	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 19.63	IN: .773	CYCLES: 54429	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 20.93	IN: .824	CYCLES: 54814	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 22.20	IN: .874	CYCLES: 55105	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 23.62	IN: .930	CYCLES: 55754	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 24.91	IN: .997	CYCLES: 56354	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 26.16	IN: 1.012	CYCLES: 56637	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 27.52	IN: 1.044	CYCLES: 56884	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 28.79	IN: 1.114	CYCLES: 55759	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 30.35	IN: 1.195	CYCLES: 55829	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 31.89	IN: 1.256	CYCLES: 55879	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 33.76	IN: 1.329	CYCLES: 55019	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 35.63	IN: 1.403	CYCLES: 55938	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 37.38	IN: 1.471	CYCLES: 55954	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 38.80	IN: 1.528	CYCLES: 55965	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 39.62	IN: 1.560	CYCLES: 55979	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 42.89	IN: 1.688	CYCLES: 55984	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 44.66	IN: 1.758	CYCLES: 55994	.1549E-03	.6340E-05	7.76
CRACK LENGTH MM: 47.10	IN: 1.856				

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TABLE D3-16

SPECIMEN NUMBER: 208-179			
ALLOY TYPE: 2024-T851			
SPECIMEN ORIENTATION: TRANSVERSE			
CONSTRAINT: UNSTIFFENED			
TEST TEMPERATURE: 25.0 °C			
SPECIMEN THICKNESS: 6.15 MM (0.242 IN)			
MAXIMUM STRESS: 118.0 MPA (17.1 KSI)			
FREQUENCY: 200 CPM			
CYCLES TO FAILURE: 196 CYCLES			
KIMAX: 196 CYCLES PRIOR TO FAILURE			
24.86 MPA SORTING: 21.98 KSI SORTING			

CRACK LENGTH			DELTA(A)/DELTA(B)		DELTA STRESS INTENSITY	
IN		CYCLES	MM/CYCLE	IN/CYCLE	MPA SORTING	KSI SORTING
.149		1	.3940E-03	.1397E-34	12.67	11.53
.171	1841		.4994E-03	.1797E-04	13.77	12.53
.202	3584		.6328E-03	.2401E-04	14.81	13.49
.231	4722		.7871E-03	.3099E-04	15.64	14.25
.252	5619		.8265E-03	.3254E-04	16.28	14.81
.269	5963		.1234E-02	.4457E-04	17.01	15.48
.300	6971		.1425E-02	.5610E-04	17.78	16.19
.323	6981		.1925E-02	.7578E-04	18.52	16.88
.350	7334		.2443E-02	.9617E-04	19.17	17.46
.372	7569		.4279E-02	.1685E-03	19.97	18.13
.399	7726		.4998E-02	.1964E-03	21.48	19.71
.432	7894		.7620E-02	.3002E-03	21.20	19.38
.456	7977		.1029E-01	.4051E-03	21.05	19.34
.447	8053		.1891E-01	.7408E-03	22.59	20.46
.511	8084					

TABLE D3-17

SPECIMEN NUMBER:				255-312
ALLOY TYPE:				2024-T851
SPECIMEN ORIENTATION:				TRANSVERSE
CONSTRAINT:				UNSTIFFENED
TEST TEMPERATURE:				25.0 C
SPECIMEN THICKNESS:				6.15 MM (.242 IN)
MAXIMUM STRESS:				198.0 MPA (28.4 KSI)
FREQUENCY:				200 CPM
CYCLES TO FAILURE:				127 CYCLES
KIMAX:				13 CYCLES PRIOR TO FAILURE
22.46 MPA SORTING:				20.38 KSI SORTING
CRACK LENGTH		DELTA(A)/DELTA(B)	DELTA STRESS INTENSITY	
MM	CYCLES	MM/CYCLE	MPA SORTING	KSI SORTING
3.35	1	.6948E-02	20.37	19.52
.132	127			

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TABLE D3-18

SPECIMEN NUMBER: 257-111
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
ENVIRONMENT: AIR
TEST TEMPERATURE: 422.0 K
SPECIMEN THICKNESS: 6.16 MM (12.5 IN)
MAXIMUM STRESS: 46.2 MPa (12.5 KSI)
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 48993 CYCLES
R (MAX): 2 CYCLES PRIOR TO FAILURE 73.44 MPa SORT(MI) 66.44 KSI SORT(MI)

CRACK LENGTH MM	IN	CYCLES	DELTA (A)/DELTA (B) MM/CYCLE	IN/CYCLE	DELTA (STRESS) MPa SORT(MI)	INTENSITY KSI SORT(MI)
3.81	.151	1	.9672E-04	.3792E-05	9.33	9.49
4.42	.174	6149	.9671E-04	.3786E-05	9.98	9.79
5.04	.198	12372	.1463E-03	.5671E-05	10.61	9.66
5.65	.222	16917	.1653E-03	.6407E-05	11.31	10.29
6.40	.255	21609	.2063E-03	.8123E-05	11.82	10.85
6.98	.275	24320	.3033E-03	.1192E-04	12.40	11.35
7.76	.316	26633	.3324E-03	.1339E-04	13.03	11.86
8.31	.327	28297	.3911E-03	.1464E-04	13.57	12.72
9.01	.355	30072	.4511E-03	.1776E-04	14.10	12.43
9.77	.385	31764	.5017E-03	.1979E-04	14.63	13.31
10.46	.411	33103	.4448E-03	.1909E-04	15.11	13.75
11.09	.437	34439	.6453E-03	.2540E-04	15.57	14.11
11.57	.455	35101	.8537E-03	.3361E-04	15.98	14.55
12.50	.492	36273	.7999E-03	.3133E-04	16.51	15.02
13.14	.517	37800	.1009E-02	.4207E-04	16.88	15.76
13.65	.538	37953	.8694E-03	.3623E-04	17.24	15.72
14.38	.566	38387	.9811E-03	.4061E-04	17.77	16.10
15.25	.600	39275	.1054E-02	.4149E-04	18.22	16.50
15.85	.624	39839	.1502E-02	.5914E-04	18.88	16.92
16.51	.650	40282	.1443E-02	.5603E-04	18.97	17.27
17.14	.675	40714	.1108E-02	.4180E-04	19.29	17.56
17.61	.693	41144	.1523E-02	.5996E-04	19.66	17.97
18.34	.723	41636	.1712E-02	.6739E-04	20.04	18.74
19.03	.749	42027	.2078E-02	.8100E-04	20.56	19.71
20.27	.798	42623	.2066E-02	.8174E-04	21.20	19.29
21.39	.842	43167	.3033E-02	.1194E-03	21.86	19.89
22.77	.896	43620	.3179E-02	.1290E-03	22.54	20.93
24.00	.948	44032	.3698E-02	.1439E-03	23.26	21.15
25.49	1.004	44420	.4150E-02	.1634E-03	24.02	21.86
27.18	1.076	44827	.4312E-02	.1698E-03	24.75	22.92
28.46	1.121	45128	.5621E-02	.2213E-03	25.39	23.10
29.85	1.175	45372	.5886E-02	.2286E-03	25.95	23.62
31.87	1.215	45947	.6016E-02	.2603E-03	26.40	24.10
32.10	1.264	45727	.7695E-02	.3014E-03	27.03	24.99
33.20	1.307	45871	.7257E-02	.2857E-03	27.58	25.39
34.47	1.357	46046	.8943E-02	.3167E-03	28.14	25.61
35.65	1.434	46193	.9388E-02	.3696E-03	28.69	26.11
36.87	1.452	46323	.9011E-02	.3948E-03	29.23	26.68
38.01	1.496	46449	.1002E-01	.4261E-03	29.76	27.08
39.23	1.544	46562	.3164E-01	.1240E-02	31.58	37.04
F	80.90	3.500	.2117E+00	.8333E-02	37.39	92.22
F	92.07	3.625	.1609E+00	.6335E-02	39.57	96.17
F	94.49	3.720	.2286E+00	.9803E-02	61.91	96.34
F	97.92	3.855	.4288E+00	.1607E-01	64.74	99.18
F	101.35	3.990	.5292E+00	.2003E-01	68.13	62.88
F	104.52	4.115				

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	SPECIMEN NUMBER:	250-442
	ALLOY TYPE:	7050-T651
	SPECIMEN ORIENTATION:	LONGITUDINAL
	CONSTRAINTS:	UNSTRESSING
	CORROSION:	CAB AIR
	TEST METHOD:	2890
	FREQUENCY:	10 Hz
	GAGE LENGTH:	1.27 IN.
	PAYLOAD:	118.7 MPa (17.2 KSI)
	R-RATIO:	0.49
	PRECRACK:	2890
KINAW	1 CYCLE TO FAILURE	NET STRESS GREATER THAN C.O.S

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TABLE D3-20

SPECIMEN NUMBERS						
SPECIMEN ORIENTATIONS						
CONSTRAINTS						
ENVIRONMENT						
TEST TEMPERATURE						
SPECIMEN THICKNESS						
MAXIMUM STRESS						
FREQUENCY						
CYCLES TO FAILURE						
NIMAX) : CYCLES PRIOR TO FAILURE						
73.32 MPA SQRT(IN) (66.73 KSI SQRT(IN))						
CPACK LENGTH	IN	MM	DELTA (A1)/DELTA (A2)	DELTA (A1)/DELTA (A2)	DELTA (A1)/DELTA (A2)	INTENSITY
MM	IN	MM	MM/CYCLE	IN/CYCLE	MPA SQRT(IN)	KSI SQRT(IN)
5.71	.455	743	.4051E-03	.117E-04	21.27	13.35
6.33	.499	1291	.1694E-02	.6677E-04	22.07	21.06
6.94	.546	2229	.1293E-02	.1070E-04	23.12	21.14
7.68	.634	3066	.2007E-02	.7911E-04	24.77	22.10
8.36	.658	3651	.2403E-02	.1107E-03	25.47	23.18
8.97	.735	3465	.4161E-02	.1674E-03	26.50	24.12
9.79	.770	4251	.1945E-02	.1569E-03	27.61	25.12
10.61	.817	4561	.5910E-02	.7149E-03	28.46	26.27
11.20	.892	4750	.6059E-02	.2345E-03	29.90	27.91
11.93	.940	4931	.9744E-02	.3838E-03	30.83	29.56
12.14	.956	4964	.6603E-02	.2600E-03	31.49	29.66
12.96	1.020	5094	.1252E-01	.4927E-03	32.20	29.90
13.62	1.073	5207	.1184E-01	.4647E-03	33.21	31.22
14.43	1.136	5299	.3092E-01	.1217E-02	34.21	31.12
15.11	1.190	5321	.2202E-01	.4668E-03	35.18	32.01
15.87	1.249	5379	.2602E-01	.1324E-02	36.11	32.46
16.64	1.310	5408	.3157E-01	.1243E-02	37.10	33.76
17.92	1.411	5483	.4917E-01	.1936E-02	38.40	34.95
19.77	1.567	5533	.6994E-01	.2754E-02	40.37	36.74
21.50	1.693	5571	.9076E-01	.3573E-02	42.60	38.77
F 22.73	1.790	5594	.9174E-01	.3613E-02	44.44	40.44
F 24.51	1.930	5614	.1775E+00	.4944E-02	46.31	42.14
F 26.12	2.057	5631	.2147E+00	.8451E-02	48.43	44.17
F 27.83	2.199	5647	.2586E+00	.1010E-01	50.49	46.04
F 29.79	2.346	5657	.3730E+00	.1469E-01	52.97	48.22
F 31.49	2.479	5667	.3383E+00	.1191E-01	55.10	50.35
F 34.41	2.719	5677	.5860E+00	.2307E-01	58.49	53.23
F 35.84	2.822	5679	.1424E+01	.5591E-01	61.61	56.37
F 38.06	2.996	5681	.2223E+01	.8743E-01	64.35	59.56
F 40.23	3.164	5682	.4351E+01	.1713E+00	67.44	61.74

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TABLE D3-21

SPECIMEN NUMBER: 750-7113
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
COMPOSITION: UNSUPPLEMENTED
TEST TEMPERATURE: 25.0 °C
SPECIMEN THICKNESS: 6.11 MM (0.24 IN)
MAXIMUM STRESS: 110.0 MPA (15.7 KSI)
FREQUENCY: 200 CYCLES
Cycles to Failure: 262
K(MAX) 96 CYCLES PRIOR TO FAILURE: 44.23 MPA SORT(M) 40.25 KSI SORT(M)

CRACK LENGTH MM	IN	CYCLES	DELTA(KA)/DELTA(IN) MM/CYCLE	IN/CYCLE	DELTA(Stress Intensity) MPa SORT(M)	KSI SORT(M)
7.93	.312	1	.1963E-02	.6193E-04	18.25	16.61
9.67	.378	426	.1607E-02	.6329E-04	19.03	17.32
9.34	.368	890	.1876E-02	.7384E-04	19.76	17.98
9.98	.392	1213	.3982E-02	.1413E-03	20.46	18.62
11.69	.461	1419	.4433E-02	.1391E-03	21.18	19.27
11.38	.448	1621	.4209E-02	.1657E-03	21.91	19.96
12.77	.479	1872	.4716E-02	.1857E-03	22.40	20.46
12.81	.504	1945	.4489E-02	.2341E-03	23.26	21.17
13.59	.535	2038	.6260E-02	.2465E-03	23.86	21.71
14.12	.556	2121	.8611E-02	.3390E-03	24.49	22.29
14.98	.590	2221	.1495E-01	.4488E-03	25.14	22.88
15.64	.613	2261	.1098E-01	.4323E-03	25.78	23.46
16.46	.647	2343	.1177E-01	.4643E-03	26.45	24.17
17.10	.673	2396	.1942E-01	.7644E-03	27.10	24.66
17.98	.708	2441	.1418E-01	.6372E-03	27.74	25.24
18.61	.733	2482	.1851E-01	.7287E-03	28.31	25.76
19.35	.762	2520	.2466E-01	.1168E-02	29.24	26.61
20.86	.821	2571	.1067E-01	.1267E-02	30.71	27.95
22.95	.903	2639	.3776E-01	.1486E-02	32.11	29.23
24.34	.958	2676	.4513E-01	.1777E-02	33.42	30.41
26.23	1.031	2717	.8661E-01	.2672E-02	34.69	31.57
27.53	1.084	2737	.7326E-01	.2884E-02	35.88	32.65
29.14	1.147	2759	.774E-01	.3047E-02	37.46	33.73
30.65	1.199	2776	.8145E-01	.3237E-02	38.34	34.86
32.25	1.271	2799	.857E-01	.3358E-02	39.49	35.91
33.27	1.311	2817	.1734E+00	.4793E-02	40.62	36.97
34.98	1.377	2821	.1376E+00	.5182E-02	41.68	37.93
39.76	1.569	2828				

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TABLE D3-22

SPECIMEN INFORMATION						
SPECIMEN NUMBER: 29-314						
ALLOY TYPE: 2024-T861						
SPECIMEN ORIENTATION: LONGITUDINAL						
CONSTRAINT: UNSTRESSING						
ENVIRONMENT: CAN AIR						
TEST TEMPERATURE: 451.0 K						
SPECIMEN THICKNESS: 6.12 MM (0.241 IN)						
MAXIMUM STRESS: 195.4 MPa (28.4 KSI)						
FREQUENCY: 260 KHz						
CYCLES TO FAILURE: 1287 CYCLES						
K(MAX): 1 CYCLES PRIOR TO FAILURE: 64.34 MPa SQRT(IN) (58.55 KSI SQRT(IN))						
CRACK LENGTH		CYCLES	DELTA (AI/DELTA IN)		DELTA (STRESS INTENSITY)	
MM	IN		MM/CYCLE	IN/CYCLE	MPa SQRT(IN)	KSI SQRT(IN)
1.93	.115	1	.1715E-02	.6750E-04	19.34	17.61
3.95	.155	594	.4959E-02	.1992E-03	22.13	20.14
5.65	.199	819	.7795E-02	.3064E-03	24.13	21.96
6.64	.222	896	.8601E-02	.3386E-03	25.46	23.16
6.25	.246	961	.1344E-01	.5292E-03	25.81	24.41
F 6.96	.274	1017	.1445E-01	.5666E-03	26.49	25.01
F 7.92	.312	1044	.3157E-01	.1243E-02	30.42	27.68
F 9.63	.355	1118	.3725E-01	.1467E-02	32.37	29.46
F 10.15	.399	1149	.3404E-01	.1363E-02	34.01	31.95
F 11.00	.433	1174	.6492E-01	.2540E-02	35.96	32.73
F 12.61	.496	1199	.9213E-01	.4213E-02	38.11	34.68
F 13.84	.545	1214	.1185E+00	.4667E-02	40.26	36.46
F 14.62	.615	1229	.1273E+00	.5030E-02	42.52	39.75
F 17.14	.675	1261	.1799E+00	.7083E-02	46.93	43.09
F 19.30	.767	1253	.2032E+00	.8070E-02	47.55	44.27
F 21.34	.842	1261	.2391E+00	.9374E-02	49.91	46.42
F 23.24	.915	1271	.2563E+00	.1000E-01	51.91	47.24
F 24.75	.975	1277	.4445E+00	.1753E 01	53.79	49.96
F 26.46	1.045	1281	.7197E+00	.2833E-01	55.90	51.45
F 28.73	1.130	1284	.1083E+01	.4250E-01	58.34	53.59
F 30.86	1.215	1286	.5083E+00	.2050E-01	59.77	54.30
F 31.37	1.235	1287	.1016E+01	.4000E-01	60.50	54.13
F 32.38	1.275	1288				

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TABLE D3-23

SPECIMEN NUMBER		250-612	
ALLOY TYPE		2024-T861	
SPECIMEN ORIENTATION		TRANSVERSE	
CONSTRAINT		UNSTRESSING	
ENVIRONMENT		LAM AIR	
TEST TEMPERATURE		453.0 K	
SPECIMEN THICKNESS		6.32 MM (0.249 IN)	
MAXIMUM STRESS		120.7 MPA (17.4 KSI)	
FREQUENCY		230 CPM	
CYCLES TO FAILURE		4965 CYCLES	
K(MAX)	1 CYCLES PRIOR TO FAILURE	INLET STRESS GREATER THAN 0.9 FTY	

CRACK LENGTH			DELTA(A)/DELTA(N)		DELTA(STRESS INTENSITY)
MM	IN	CYCLES	MM/CYCLE	IN/CYCLE	MPA SORT(N) KSI SORT(N)
6.40	.254	1			
9.17	.361	2491	.1737E-02	.6843E-04	25.73 23.42
10.68	.419	3203	.2461E-02	.1126E-03	28.27 25.72
12.19	.483	3733	.7445E-02	.3132E-03	30.60 27.85
13.15	.518	3941	.9107E-02	.1542E-03	32.74 29.43
14.69	.579	4273	.1423E-01	.5631E-03	34.08 31.02
15.11	.595	4235	.1551E-01	.4105E-03	35.41 32.22
16.48	.649	4354	.1831E-01	.7237E-03	36.99 33.66
17.83	.701	4464	.2448E-01	.4639E-03	38.75 35.36
19.01	.750	4530	.1573E-01	.1487E-02	40.37 36.74
20.17	.799	4584	.4723E-01	.1771E-02	41.86 38.19
21.31	.848	4635	.4451E-01	.1755E-02	43.32 39.62
22.75	.901	4697	.4469E-01	.1956E-02	44.95 40.98
24.33	.961	4741	.6571E-01	.2587E-02	46.46 42.64
26.17	1.030	4793	.7065E-01	.2742E-02	48.04 44.63
29.09	1.144	4827	.1718E+00	.6764E-02	52.13 47.44
31.05	1.224	4854	.1264E+00	.4975E-02	55.40 50.42
32.33	1.274	4875	.1514E+00	.5461E-02	57.65 52.66
36.33	1.430	4903	.3196E+00	.1258E-01	61.47 56.94
F	40.41	4920	.4078E+00	.1836E-01	67.80 61.71
F	42.61	4932	.1675E+00	.1447E-01	73.71 66.71
F	46.43	4950	.4251E+00	.1673E-01	79.27 71.74
F	48.74	4959	.9120E+00	.7017E-01	88.16 79.70
F	51.14	4961			
F	55.73	4961			INLET STRESS GREATER THAN 0.9 FTY
F	57.66	4964			INLET STRESS GREATER THAN 0.9 FTY
F					INLET STRESS GREATER THAN 0.9 FTY

TABLE D3-24

SPECIMEN NUMBER		250-613	
ALLOY TYPE		2024-T861	
SPECIMEN ORIENTATION		TRANSVERSE	
CONSTRAINT		UNSTRESSING	
ENVIRONMENT		LAM AIR	
TEST TEMPERATURE		453.0 K	
SPECIMEN THICKNESS		6.32 MM (0.249 IN)	
MAXIMUM STRESS		145.4 MPA (21.4 KSI)	
FREQUENCY		200 CPM	
CYCLES TO FAILURE		1721 CYCLES	
K(MAX)	1 CYCLES PRIOR TO FAILURE	57.04 MPA SORT(M)	46.37 KSI SORT(N)

CRACK LENGTH		CYCLES	DELTA(A)/DELTA(N)		DELTA(STRESS INTENSITY)	
MM	IN		MM/CYCLE	IN/CYCLE	MPA SORT(M)	KSI SORT(N)
2.62	.103	1				
3.65	.144	574	.1746E-02	.7879E-04	18.46	16.46
4.41	.174	775	.3818E-02	.1593E-03	20.97	19.15
4.65	.183	909	.1829E-02	.7201E-04	22.20	20.20
F	6.24	1016	.1478E-01	.5818E-03	24.34	22.15
F	7.25	1116	.1616E-01	.4000E-03	27.18	24.66
F	8.22	1346	.3217E-01	.1247E-02	29.03	26.42
F	9.45	1374	.4106E-01	.1617E-02	31.04	28.25
F	10.30	1391	.5671E-01	.2233E-02	32.84	29.89
F	11.96	1236	.1109E+00	.4367E-02	36.89	31.76
F	13.07	1213	.8497E-01	.1344E-02	37.83	33.70
F	14.12	1225	.1757E+00	.6417E-02	38.63	35.19
F	15.41	1229	.3207E+00	.1262E-01	40.24	36.67
F	16.18	1232	.2582E+00	.1017E-01	41.71	37.98
F	17.03	1235	.2836E+00	.1117E-01	42.80	38.95
F	18.44	1237	.7000E+00	.2775E-01	44.28	40.38
F	19.93	1234	.7429E+00	.2925E-01	46.12	41.97
F	20.95	1240	.1029E+01	.4058E-01	47.68	43.19

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FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

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TABLE 03-25

SPECIMEN NUMBER: 252-J111						
ALLOY TYPE: 2024-T861						
SPECIMEN ORIENTATION: LONGITUDINAL						
CONSTRAINT: UNSTRESS						
TEST ENVIRONMENT: LAB AIR						
TEST TEMPERATURE: 478.0 °K						
SPECIMEN THICKNESS: 6.22 MM (0.245 IN)						
MAXIMUM STRESS: 118.0 MPA (17.0 KSI)						
FRACTURE TYPE: 252 J111						
CYCLES TO FAILURE: 6197 CYCLES						
(MINUS) 1 CYCLE PRIOR TO FAILURE (NET STRESS GREATER THAN 5.9 FTY)						
CRACK LENGTH	MM	IN	CYCLES	DELTA(A)/DELTA(S)	DELTA STRESS	INTENSITY
				MM/CYCLE	MPA SORT(IN)	KSI SORT(IN)
5.46	.447		1	.1885E-02	.6635E-04	21.99
6.35	.500		792	.1885E-02	.7887E-04	23.86
6.86	.543		1367	.1885E-02	.6639E-04	24.00
7.42	.586		2823	.2921E-02	.1150E-03	25.54
8.71	.686		2909	.4157E-02	.1647E-03	27.23
9.54	.752		3310	.5741E-02	.2276E-03	28.45
10.85	.854		3761	.5320E-02	.2894E-03	30.54
11.84	.935		4149	.7550E-02	.2972E-03	32.27
13.32	1.049		4531	.1162E-01	.4576E-03	33.82
14.17	1.116		4677	.1137E-01	.4474E-03	35.29
15.54	1.224		4910	.1533E-01	.6037E-03	37.01
16.83	1.325		5046	.2034E-01	.8009E-03	38.57
17.99	1.416		5201	.1863E-01	.7359E-03	40.08
19.23	1.514		5333	.3235E-01	.1273E-02	42.77
22.32	1.757		5524	.6663E-01	.2623E-02	45.91
24.24	1.912		5533	.2610E-01	.1027E-02	47.65
25.11	1.977		5646	.5944E-01	.2342E-02	49.22
26.77	2.104		5702	.2544E-01	.1003E-02	50.51
27.14	2.137		5731	.4671E-01	.3414E-02	52.00
29.09	2.301		5776	.7493E-01	.2950E-02	51.94
30.10	2.370		5803	.7485E-01	.3026E-02	55.44
31.37	2.470		5836	.1371E+00	.4217E-02	57.27
32.76	2.590		5862	.1008E+00	.3968E-02	59.23
34.18	2.701		5891	.1405E+00	.5533E-02	61.10
35.37	2.785		5907	.1362E+00	.5362E-02	63.05
36.86	2.898		5929	.1604E+00	.6317E-02	65.44
38.40	3.024		5944	.1536E+00	.5443E-02	64.34
40.53	3.191		5974	.1690E+00	.4461E-02	72.26
F 42.90	3.378		6042	.1572E+00	.6149E-02	76.29
F 44.87	3.533		6027	.4920E-01	.7512E-02	70.37
F 45.98	3.622		6052	.2185E+00	.4402E-02	47.90
F 48.15	3.733		6072	.3811E+00	.1501E-01	80.46
F 51.03	4.018		6087			
F 52.99	4.170		6112			
F 54.13	4.241		6117			
F 56.24	4.429		6127			
F 57.32	4.513		6132			
F 59.64	4.696		6147			
F 62.94	4.872		6157			
F 63.77	4.942		6167			
F 65.71	5.174		6177			
F 67.32	5.200		6182			
F 68.84	5.420		6187			
F 71.07	5.496		6192			
F 72.96	5.743		6195			
F 74.37	5.944		6196			

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FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

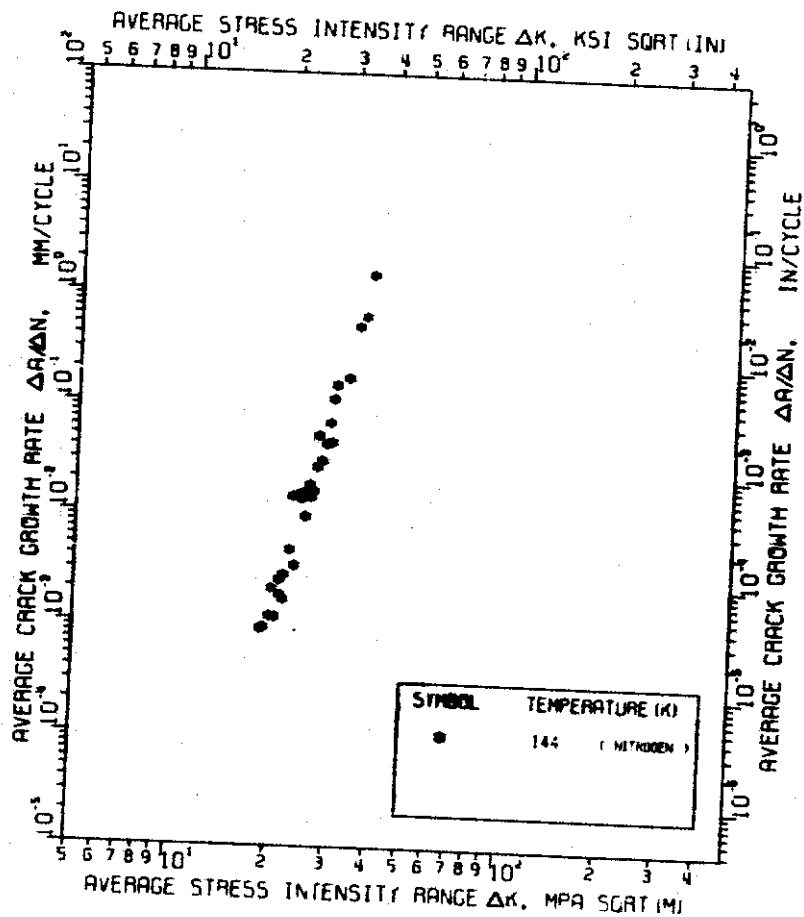
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TABLE D3-26

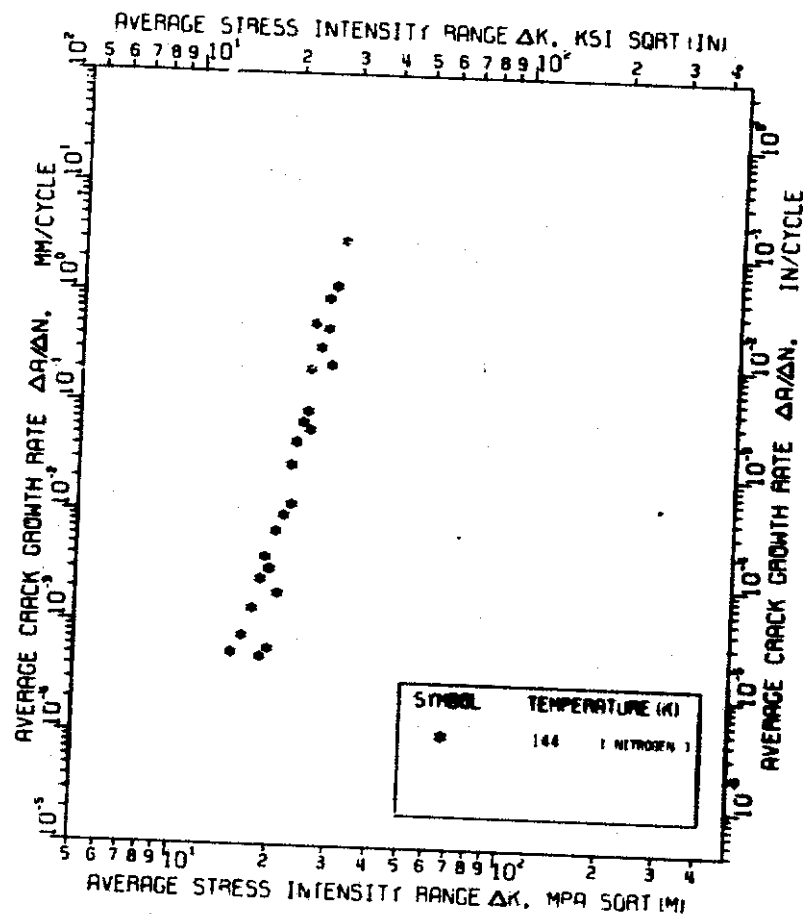
SPECIMEN NUMBER							250-177
SLOTTED TYPE							2024-T861
SPECIMEN ORIENTATION							TRANSVERSE
CONSTRAINTS							UNSTRESS
ENVIRONMENT							LAB AIR
TEST TEMPERATURE							6.53 PM 1.2000 IN
SPECIMEN THICKNESS							112.6 MPa 117.2 KSI
MAXIMUM STRESS							280 MPa
FREQUENCY							4650 CYCLES
CYCLES TO FAILURE							1 CYCLES PRIOR TO FAILURE
K(4X)							INLET STRESS GREATER THAN 0.9 FTYI
CRACK LENGTH	IN	CYCLES	DELTA K(1)/DELTA K(2)	IN/CYCLE	DELTA STRESS	INSTEAD OF	INTENSITY
IN	IN	IN	IN/CYCLE	IN/CYCLE	MPa SORT(14)	KSI SORT(14)	KSI SORT(14)
6.31	.456	1	.1557E-02	.7687E-04	23.13		21.05
7.17	.591	1435	.1390E-02	.6414E-03	25.15		22.88
8.27	.671	1037	.3469E-02	.1367E-03	25.63		24.24
9.22	.726	2541	.5672E-02	.2154E-03	26.37		25.55
10.14	.748	2879	.6486E-02	.2554E-03	26.28		26.65
11.14	.853	3094	.7976E-02	.3147E-03	30.38		27.65
11.66	.914	3331	.7595E-02	.2990E-03	31.16		28.54
12.33	.993	3440	.1276E-01	.5025E-03	32.44		29.52
13.22	1.041	3635	.1361E-01	.5121E-03	33.79		30.75
14.22	1.120	3759	.1586E-01	.6243E-03	35.01		31.86
15.16	1.145	3844	.1569E-01	.7752E-03	36.39		32.84
15.88	1.231	3948	.1703E-01	.6786E-03	36.96		33.63
16.40	1.231	4009	.2384E-01	.1094E-02	37.78		34.50
17.17	1.352	4064	.3291E-01	.1296E-02	38.43		35.34
18.17	1.423	4116	.4780E-01	.1606E-02	39.93		36.34
18.91	1.489	4160	.4359E-01	.1716E-02	41.32		37.60
20.37	1.549	4224	.4715E-01	.1856E-02	43.07		39.19
21.72	1.710	4294	.5781E-01	.2276E-02	44.71		40.69
22.38	1.828	4327	.8463E-01	.3332E-02	46.19		42.04
24.17	1.858	4354	.9905E-01	.3898E-02	46.88		43.76
26.98	2.046	4392	.1224E+02	.4834E-02	51.19		46.58
28.98	2.243	4441	.1549E+02	.7288E-02	53.92		49.07
30.16	2.377	4454	.2107E+02	.8294E-02	60.33		54.98
F	39.31	3.016	4531				
F	40.47	3.147	4551	.2165E+02	.8524E-02	64.23	62.09
F	43.22	3.423	4568	.3235E+02	.1274E-01	72.46	65.94
F	44.15	3.783	4594	.3715E+02	.1463E-01	75.76	72.59
F	49.71	3.915	4604	.3333E+02	.1311E-01	87.04	79.21
F	51.43	4.050	4614	(INLET STRESS GREATER THAN 0.9 FTYI)			
F	55.47	4.352	4624	(INLET STRESS GREATER THAN 0.9 FTYI)			
F	57.75	4.547	4634	(INLET STRESS GREATER THAN 0.9 FTYI)			
F	60.93	4.796	4644	(INLET STRESS GREATER THAN 0.9 FTYI)			
F	64.16	5.052	4649	(INLET STRESS GREATER THAN 0.9 FTYI)			
F	67.22	5.293	4654	(INLET STRESS GREATER THAN 0.9 FTYI)			
F	71.11	5.520	4658	(INLET STRESS GREATER THAN 0.9 FTYI)			

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(a) Longitudinal



(b) Transverse



Alloy: 2024-T861

Stress Ratio: .05

Frequency: 200 cpm

Thickness: 6.35 mm (.250 inch)

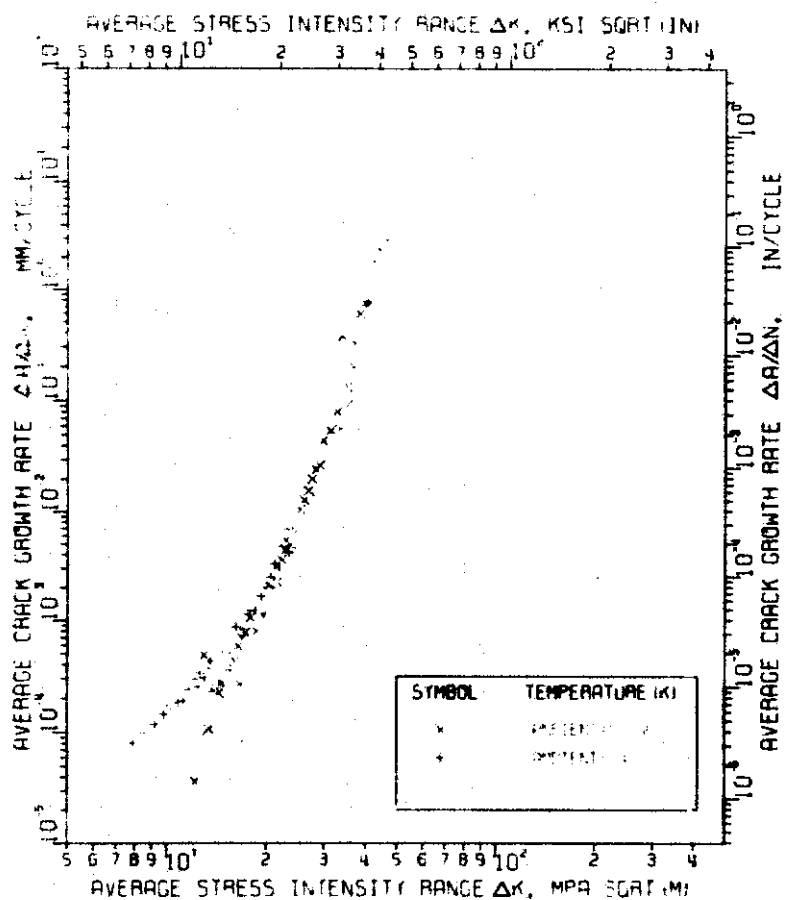
Constraint: Unstiffened

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

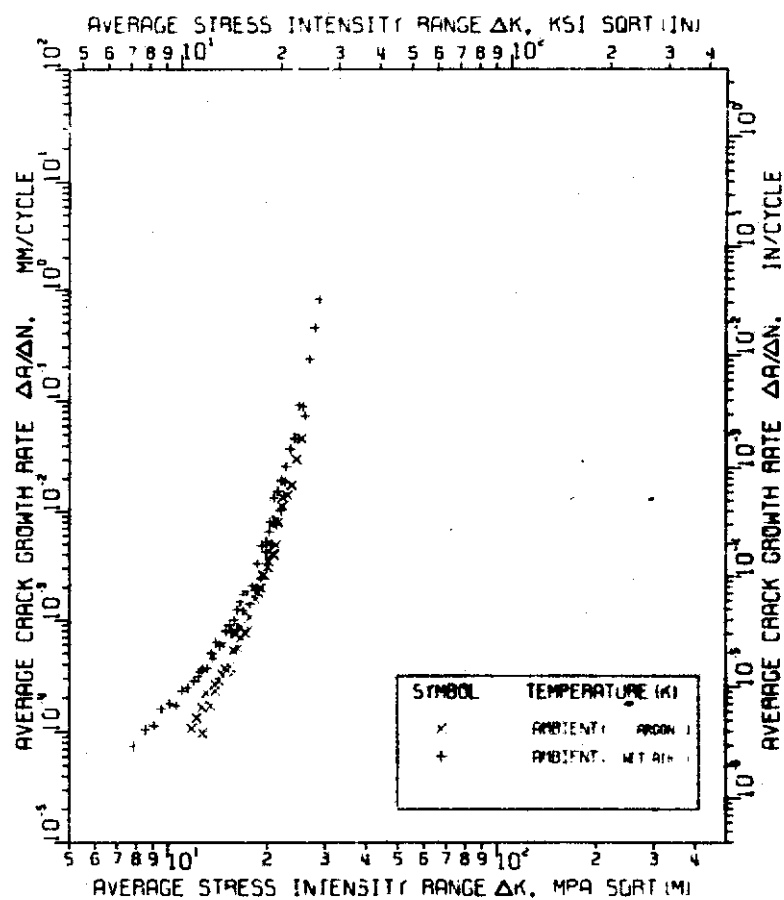
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(a) Longitudinal



(b) Transverse



Alloy: 2024-T861

Stress Ratio: .05

Frequency: 200 cpm

Thickness: 6.35 mm (.250 inch)

Constraint: Unstiffened

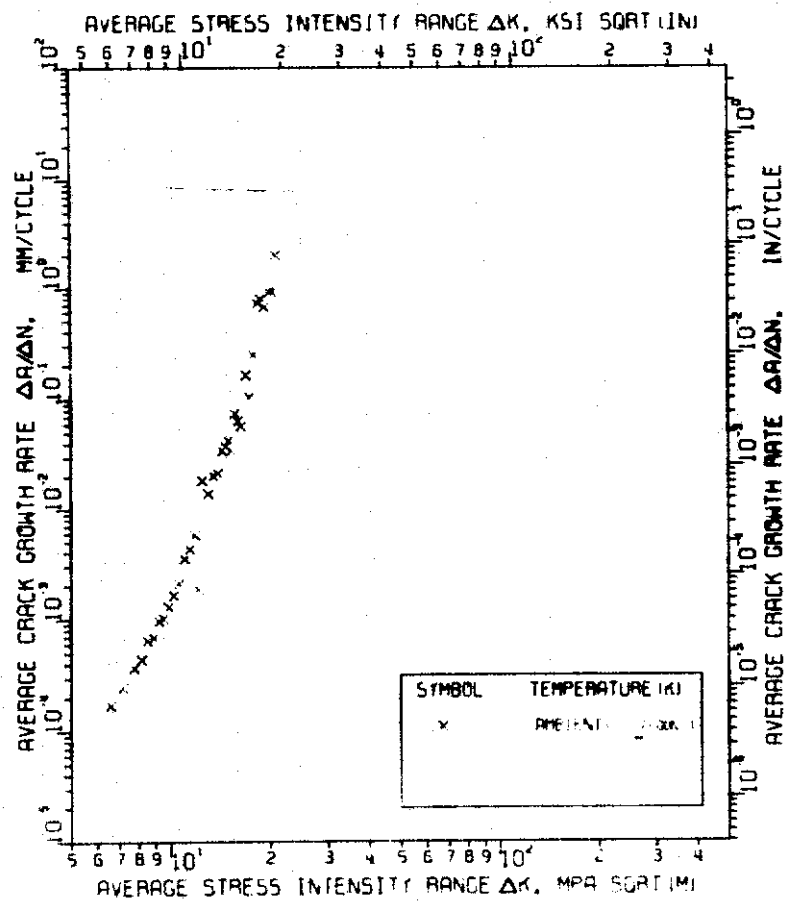
AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

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FIGURE D3-2

Longitudinal



Alloy: 2024-T861

Stress Ratio: .50

Frequency: 200 cpm

Thickness: 6.35 mm (.250 inch)

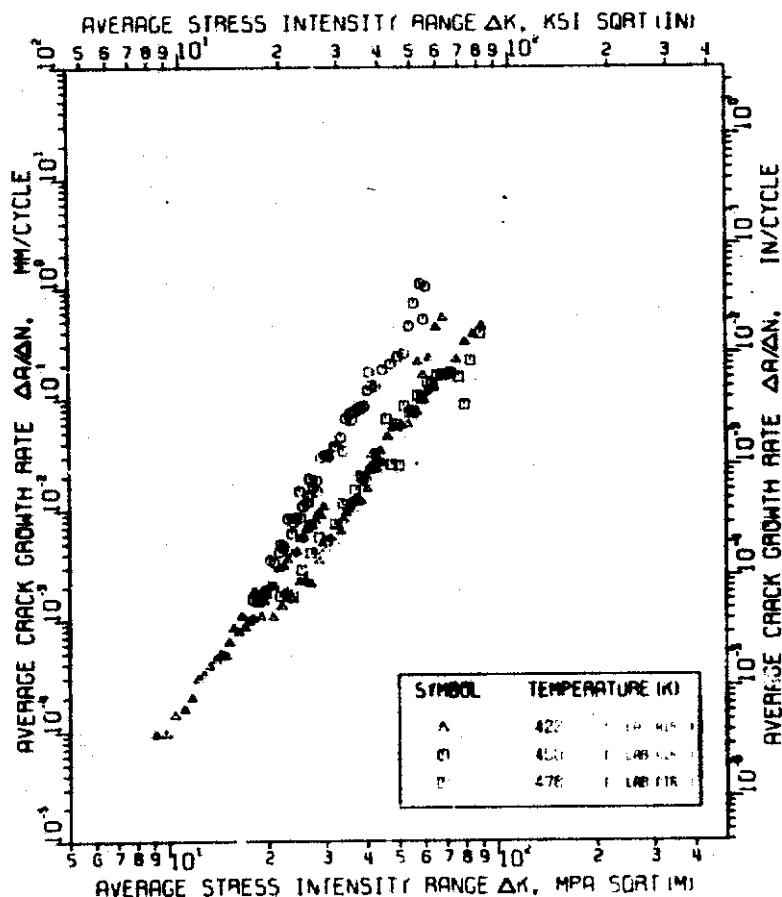
Constraint: Unstiffened

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

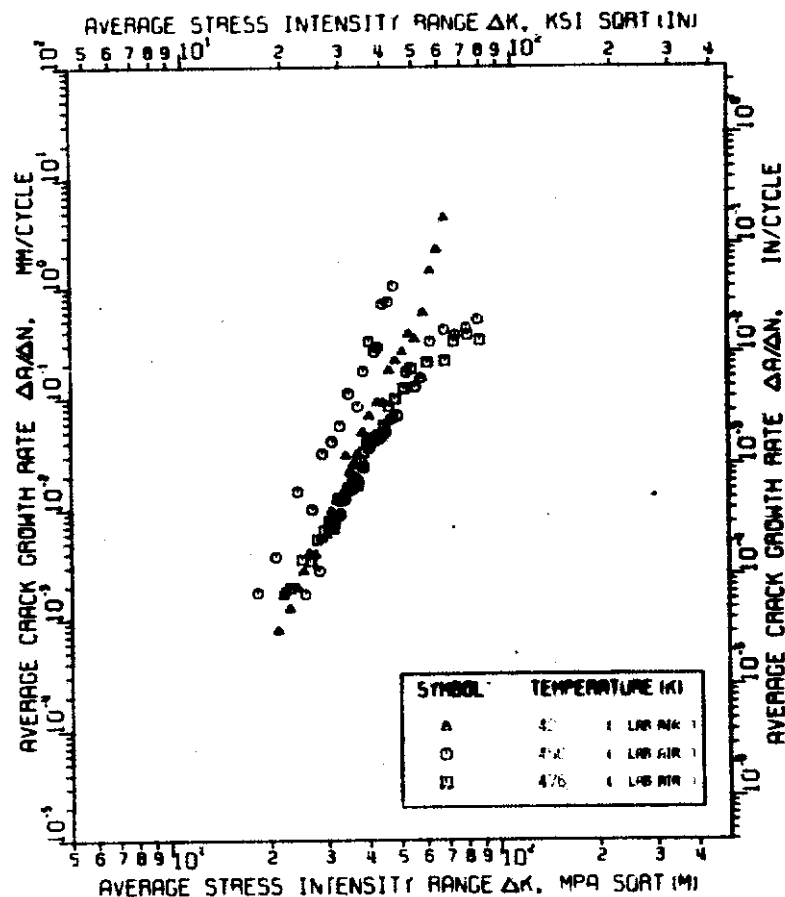
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FIGURE D3-3

(a) Longitudinal



(b) Transverse



Alloy: 2024-T861

Stress Ratio: .05

Frequency: 200 cpm

Thickness: 6.35 mm (.250 inch)

Constraint: Unstiffened

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

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**FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851**

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**SECTION D4 - - FLAW GROWTH RATE DATA
FOR 6.35 mm (.250 INCH) THICK 2024-T861
AND 2124-T851 (CYCLIC FREQUENCY: 20 CPM)**

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MCDONNELL DOUGLAS AERONAUTICS COMPANY - EAST

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FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

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TABLE D4-1. SUMMARY OF SPECIMEN TEST CONDITIONS FOR 20 CPM TESTS OF
6.35 mm (.250 INCH) THICK 2024-T861 AND 2124-T851

<u>Test Temperature (°K)</u>	<u>Stress Ratio</u>	<u>Test Direction</u>	<u>Alloy</u>	<u>Specimen I.D.</u>	<u>Data Table No.</u>	<u>Figure No.</u>
298 (Argon)	.05	T	2024-T861	250-4T6	D4-2	D4-1(a)
				250-3T4	D4-3	D4-1(a)
			2124-T851	2T7-253-3	D4-4	D4-1(b)
				3T3-256-2	D4-5	D4-1(b)
				1T4-259-3	D4-6	D4-1(b)
298 (Wet Air)	.05	T	2024-T861	250-1T12	D4-7	D4-1(a)
				250-1T11	D4-8	D4-1(a)
				250-1T8	D4-9	D4-1(a)
			2124-T851	3T5-253-2	D4-10	D4-1(b)
				5T2-256-2	D4-11	D4-1(b)
				2T6-259-2	D4-12	D4-1(b)
450	.05	T	2024-T861	250-1T1	D4-13	D4-2(a)
				250-2T2	D4-14	D4-2(a)
				250-2T6	D4-15	D4-2(a)
			2124-T851	2T4-253-1	D4-16	D4-2(b)
				1T6-256-3	D4-17	D4-2(b)
				5T5-259-1	D4-18	D4-2(b)

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FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T861

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TABLE D4-2

SPECIMEN NUMBER: 25-4476				ALLOY TYPE: 2124-T861				TEST TEMPERATURE: 308.9 K				SPECIMEN THICKNESS: 6.31 MM (1/4 IN)				MAXIMUM STRESS: 74.4 MPA (10.6 KSI)				FREQUENCY: 20 Hz				CYCLES TO FAILURE: 20,848			
SPECIMEN ORIENTATION: TRANSVERSE				CONSTRAINTS: UNSTIFFENED				ARGON												GRIP FAILURE							
CRACK LENGTH		IN		CYCLES	DELTA(A)/DELTA(B)		DELTA(Stress Intensity)		DELTA(Stress Intensity)		INTENSITY		INTENSITY		INTENSITY		INTENSITY		INTENSITY		INTENSITY		INTENSITY				
MM					MM/CYCLE		IN/CYCLE		MPa Sqrt(In)		KSI Sqrt(In)		KSI Sqrt(In)		KSI Sqrt(In)		KSI Sqrt(In)		KSI Sqrt(In)		KSI Sqrt(In)		KSI Sqrt(In)				
10.01	.394			1	.2721E-03	.1071E-04	12.06	11.71																			
10.89	.429			3212	.1933E-03	.6025E-05	13.27	12.68																			
11.36	.447			6291	.1377E-03	.4270E-05	13.64	12.41																			
12.12	.477			11872	.2671E-03	.1064E-04	14.14	13.47																			
13.08	.515			15492	.4299E-03	.1692E-04	14.67	13.26																			
13.66	.538			16898	.3295E-03	.1297E-04	14.86	13.53																			
14.14	.557			18261	.2815E-03	.1104E-04	15.17	13.77																			
14.66	.577			20088	.3789E-03	.1492E-04	15.39	14.11																			
15.11	.595			21274	.4988E-03	.1964E-04	15.72	14.29																			
15.82	.623			22788	.5461E-03	.2191E-04	16.03	14.59																			
16.40	.646			24769	.6188E-03	.2476E-04	16.39	14.92																			
17.25	.679			25144	.5622E-03	.2213E-04	16.81	15.29																			
18.02	.709			26504	.6881E-03	.2709E-04	17.23	15.68																			
19.04	.752			27884	.9947E-03	.3915E-04	17.79	16.19																			
20.35	.801			29318	.8398E-03	.3337E-04	18.21	16.96																			
20.81	.819			29852																							

TABLE D4-3

SPECIMEN NUMBER:		250-374	
SLOT TYPE:		2024-T861	
SPECIMEN ORIENTATION:		TRANSVERSE	
CONSTRAINTS:		UNSTIFFENED	
ENVIRONMENT:		ARGON	
TEST TEMPERATURE:		301.5 K	
SPECIMEN THICKNESS:		6.27 MM (1/4 IN)	
MAXIMUM STRESS:		198.6 MPA (28.4 KSI)	
FREQUENCY:		20 KHZ	
CYCLES TO FAILURE:		684 CYCLES	
N(MAN)		2 CYCLES PRIOR TO FAILURE	
		21.67 MPA SQRT(M) (19.72 KSI SQRT(IN))	

CRACK LENGTH	MM	IN	CYCLES	DELTA(A)/DELTA(B)	MM/CYCLE	IN/CYCLE	DELTA(Stress Intensity)	MPa Sqrt(In)	KSI Sqrt(In)
3.24	.127		665	.4437E-03	.1747E-04		19.46		17.71
3.53	.139		665	.1344E-01	.5289E-03		20.24		18.82
3.79	.149		684						

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FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

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TABLE D4-4

SPECIMEN NUMBER: 217-253-3			
ALLOY TYPE: 2124-T851			
SPECIMEN ORIENTATION: TRANSVERSE			
CONSTRAINT: UNSTIFFENED			
ENVIRONMENT: ARGON			
TEST TEMPERATURE: 300.4 K			
SPECIMEN THICKNESS: 6.46 MM (0.254 IN)			
MAXIMUM STRESS: 143.2 MPA (20.7 KSI)			
FREQUENCY: 20 CPM			
CYCLES TO FAILURE: 1678 CYCLES			
K(MAX) 1 CYCLES PRIOR TO FAILURE: 54.22 MPA SQRT(M) / 49.34 KSI SQRT(IN)			

CRACK LENGTH MM	IN	CYCLES	DELTA(I)/DELTA(II) MM/CYCLE	IN/CYCLE	DELTA(III) STRESS MPA SQRT(M)	INTENSITY KSI SQRT(IN)
10.39	.409	1	.2253E-02	.8957E-04	24.58	22.36
11.21	.441	364	.2415E-02	.9507E-04	25.47	23.14
11.96	.468	644	.547EE-02	.2156E-03	26.37	24.11
12.93	.509	837	.417AE-02	.1644E-03	27.25	24.80
13.56	.533	982	.431AF-02	.2376E-03	27.85	25.35
14.10	.555	1075	.6464E-02	.2545E-03	28.41	26.44
14.63	.575	1153	.9004E-02	.3546E-03	29.28	26.84
15.06	.585	1293	.1298E-01	.5119E-03	30.33	27.60
16.76	.661	1362	.1641E-01	.6655E-03	31.32	28.50
17.96	.707	1433	.2997E-01	.1100E-02	32.15	29.25
18.56	.731	1453	.5447E-01	.2318E-02	33.60	31.58
F	21.21	.834	.2222E-01	.8750E-03	35.14	31.98
F	22.10	.770	.7197E-01	.2833E-02	36.47	33.15
F	24.26	.955	.2961E-01	.1167E-02	37.68	34.29
F	25.15	.990	.5715E-01	.2253E-02	38.51	35.24
F	26.29	1.035	.7620E-01	.3003E-02	39.40	35.88
F	27.43	1.080	.1345E+00	.5244E-02	41.66	37.91
F	32.00	1.240	.4233E+00	.1667E-01	43.89	39.94
F	33.27	1.310	.5089E+00	.2000E-01	44.75	41.73
F	34.29	1.390	.8255E+00	.3250E-01	45.78	41.63
F	35.94	1.415	.1774E+01	.7400E-01	47.02	42.79
F	37.72	1.485	.2667E+01	.1050E+00	48.66	44.29
F	40.39	1.590	.2546E+01	.1000E+00	50.54	46.13
F	42.93	1.690				

TABLE D4-5

SPECIMEN NUMBER: 317-244-2			
ALLOY TYPE: 2124-T851			
SPECIMEN ORIENTATION: TRANSVERSE			
CONSTRAINT: UNSTIFFENED			
ENVIRONMENT: ARGON			
TEST TEMPERATURE: 301.5 K			
SPECIMEN THICKNESS: 6.58 MM (0.259 IN)			
MAXIMUM STRESS: 214.7 MPA (31.1 KSI)			
FREQUENCY: 20 CPM			
CYCLES TO FAILURE: 417 CYCLES			
K(MAX) 2 CYCLES PRIOR TO FAILURE: 53.72 MPA SQRT(M) / 48.88 KSI SQRT(IN)			

CRACK LENGTH	IN	CYCLES	DELTA(I)/DELTA(II)	MM/CYCLE	IN/CYCLE	DELTA(III) STRESS	INTENSITY
						MPA SQRT(M)	KSI SQRT(IN)
7.15	.282	1	.9244E-02	.7641E-03	31.31	24.49	
7.81	.307	72	.1434E-01	.6317E-03	33.47	31.40	
9.43	.371	171	.1764E-01	.6947E-03	36.86	33.55	
11.24	.443	274	.1729E-01	.6806E-03	38.93	35.43	
11.74	.464	317	.2740E-01	.1055E-02	40.25	36.61	
12.81	.504	344	.1730E-01	.1468E-02	42.01	38.23	
13.93	.548	374	.2557E-01	.2186E-02	43.44	39.75	
14.97	.590	392	.1184E+00	.4674E-02	45.24	41.14	
17.10	.670	401	.1719E+00	.6747E-02	46.43	42.26	
16.91	.660	414	.2997E+01	.1174E+00	48.95	44.55	
19.51	.768	405					

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FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

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TABLE D4-6

SPECIMEN NUMBER: 116-799-7			
ALLOY TYPE: 2124-T851			
SPECIMEN ORIENTATION: TRANSVERSE			
CONSTRAINT: UNSTIFFENED			
ENVIRONMENT: AIR			
TEST TEMPERATURE: 295.0 K			
SPECIMEN THICKNESS: 6.76 MM (1/4 IN)			
MAXIMUM STRESS: 172.4 MPa (54.1 KSI)			
R-RATIO: 0.2			
FREQUENCY: 20 CPS			
CYCLES TO FAILURE: 164 CYCLES			
KINAXI: 1 CYCLES PRIOR TO FAILURE: 58.8 MPa SORT(M) 53.61 KSI SORT(M)			

CRACK LENGTH			DELTA(A)/DELTA(I)	DELTA(II)/DELTA(I)	DELTA(III)/DELTA(I)	DELTA(IV)/DELTA(I)
MM	IN	CYCLES	MM/CYCLE	IN/CYCLE	MPa SORT(M)	KSI SORT(M)
2.62	.103	1				
2.78	.109	67	.0447E-02	.3324E-01	31.39	24.56
3.21	.127	117	.0717E-02	.3439E-03	34.37	31.28
3.77	.149	137	.0837E-01	.1193E-02	37.12	37.78
4.91	.193	153	.0320E-01	.2492E-02	41.39	37.87
5.75	.226	160	.1669E-00	.0570E-02	45.87	41.74
7.49	.291	165	.0207E-00	.1684E-01	51.90	47.23

TABLE D4-7

SPECIMEN NUMBER: 202-T12			
ALLOY TYPE: 2024-T861			
SPECIMEN ORIENTATION: TRANSVERSE			
CONSTRAINT: UNSTIFFENED			
ENVIRONMENT: AIR			
TEST TEMPERATURE: 295.0 K			
SPECIMEN THICKNESS: 6.27 MM (1/4 IN)			
MAXIMUM STRESS: 74.6 MPa (11.8 KSI)			
R-RATIO: 0.2			
FREQUENCY: 20 CPS			
CYCLES TO FAILURE: GRIP FAILURE			

CRACK LENGTH			DELTA(A)/DELTA(I)	DELTA(II)/DELTA(I)	DELTA(III)/DELTA(I)	DELTA(IV)/DELTA(I)
MM	IN	CYCLES	MM/CYCLE	IN/CYCLE	MPa SORT(M)	KSI SORT(M)
7.75	.305	1				
8.76	.345	3789	.02672E-03	.1052E-04	11.41	10.39
9.45	.372	6732	.02304E-03	.9386E-05	11.99	13.91
9.88	.389	8583	.02250E-03	.8856E-05	12.36	11.25
10.76	.425	10780	.04114E-03	.1621E-04	12.78	11.63
11.35	.447	12294	.03786E-03	.1491E-04	13.24	12.15
12.22	.481	13785	.05031E-03	.2244E-04	13.67	12.44
12.96	.510	15014	.06046E-03	.2383E-04	14.13	12.46
13.69	.539	16199	.06167E-03	.2428E-04	14.55	13.24
14.22	.560	17150	.05764E-03	.2269E-04	14.89	13.45
15.11	.594	18195	.04235E-03	.1197E-04	15.27	13.90
15.92	.627	19214	.05144E-03	.1155E-04	15.72	14.31
16.66	.656	19979	.07778E-03	.1857E-04	16.12	14.67
17.24	.679	20442	.1237E-02	.4970E-04	16.44	14.98
17.87	.703	22822	.1677E-02	.6574E-04	16.76	15.25

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2024-T061 AND 2124-T051

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TABLE D4-8

SPECIMEN NUMBER:		253-1711
ALLOY TYPE:		2024-T061
SPECIMEN ORIENTATION:		TRANSVERSE
CONSTRAINT:		UNSTIFFENED
ENVIRONMENT:		NET AIR
TEST TEMPERATURE:		300.0 K
SPECIMEN THICKNESS:		6.12 MM (0.241 IN)
MAXIMUM STRESS:		117.6 MPA (17.0 KSI)
R-RATIO:		0.25
FREQUENCY:		20.0 CPM
CYCLES TO FAILURE:		8369 CYCLES
K(IMAX) 246 CYCLES PRIOR TO FAILURE:		24.61 MPA SQRT(IN) (22.4 KSI SQRT(IN))

CRACK LENGTH			DELTA(A)/DELTA(N)	DELTA(1/STRESS INTENSITY)
MM	IN	CYCLES	MM/CYCLE	IN/CYCLE
4.17	.164	1	.3315E-03	.1703E-04
5.15	.203	2959	.5448E-03	.2149E-04
5.79	.228	4127	.6453E-03	.2541E-04
5.98	.236	4434	.5595E-03	.2203E-04
6.11	.241	4661	.9058E-03	.3566E-04
6.88	.271	5477	.1101E-02	.4335E-04
7.75	.305	6292	.1236E-02	.4865E-04
8.38	.330	6837	.1773E-02	.6942E-04
9.08	.357	7194	.2187E-02	.8582E-04
9.69	.382	7481	.3236E-02	.1274E-03
10.67	.420	7781	.5626E-02	.2215E-03
11.27	.444	7888	.5994E-02	.2356E-03
12.16	.475	8121	.8332E-02	.3281E-03
12.54	.495	8192	.1849E-01	.7281E-03
13.33	.525	8121		

TABLE D4-9

SPECIMEN NUMBER:		253-1711
ALLOY TYPE:		2024-T061
SPECIMEN ORIENTATION:		TRANSVERSE
CONSTRAINT:		UNSTIFFENED
ENVIRONMENT:		NET AIR
TEST TEMPERATURE:		300.0 K
SPECIMEN THICKNESS:		6.35 MM (0.250 IN)
MAXIMUM STRESS:		198.2 MPA (28.4 KSI)
R-RATIO:		0.25
FREQUENCY:		20.0 CPM
CYCLES TO FAILURE:		166 CYCLES
K(IMAX) 165 CYCLES PRIOR TO FAILURE:		34.2 MPA SQRT(IN) (31.12 KSI SQRT(IN))

CRACK LENGTH			DELTA(A)/DELTA(N)	DELTA(1/STRESS INTENSITY)
MM	IN	CYCLES	MM/CYCLE	IN/CYCLE
4.73	.177	1		

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FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

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TABLE D4-10

SPECIMEN NUMBER:			375-252-2			
ALLOY TYPE:			2024-T861			
SPECIMEN ORIENTATION:			TRANSVERSE			
CONSTRAINT:			UNSTIFFENED			
ENVIRONMENT:			WET AIR			
TEST TEMPERATURE:			297.3 K			
SPECIMEN THICKNESS:			6.35 MM (1/4 IN)			
MAXIMUM STRESS:			217.0 MPa (31.5 KSI)			
FREQUENCY:			2.0 CPS			
CYCLES TO FAILURE:			1403 CYCLES			
K(MAX)			54.91 MPa SQRT(IN) (49.97 KSI SQRT(IN))			
2 CYCLES PRIOR TO FAILURE:						
CRACK LENGTH			DELTA(A)/DELTA(N)	DELTA(Stress Intensity)		
MM	IN	CYCLES	MM/CYCLE	IN/CYCLE	MPa SQRT(IN)	KSI SQRT(IN)
9.95	.392	1	.2163E-02	.4519E-04	23.91	21.77
10.53	.415	267	.5893E-02	.2845E-03	24.82	22.59
11.50	.453	457	.4771E-02	.1878E-03	25.68	23.37
12.06	.475	574	.5391E-02	.2122E-03	26.96	24.17
13.13	.516	764	.7436E-02	.3085E-03	27.64	25.20
14.20	.559	989	.7222E-02	.2843E-03	28.61	26.04
14.92	.587	1008	.1119E-01	.4408E-03	29.33	26.69
15.64	.616	1072	.1202E-01	.4733E-03	30.02	27.32
16.33	.643	1133	.6124E-02	.2491E-03	30.53	27.78
16.70	.657	1189	.2074E-01	.8167E-03	31.08	28.29
17.51	.689	1227	.1044E-01	.4110E-03	31.75	28.99
18.13	.714	1286	.2554E-01	.1005E-02	32.36	29.44
18.84	.742	1314	.1265E-01	.4981E-03	32.98	30.01
19.51	.764	1367	.1734E-01	.6827E-03	33.70	30.67
20.46	.804	1422	.7217E-01	.1269E-02	34.64	31.52
21.65	.852	1499	.3745E-01	.1473E-02	35.66	32.45
22.85	.900	1491	.5425E-01	.2136E-02	36.79	33.48
24.37	.959	1519	.4578E-01	.1802E-02	37.83	34.43
25.34	.999	1541	.5691E-01	.2240E-02	38.72	35.24
26.57	1.046	1562	.1264E+00	.4975E-02	39.60	36.04
27.58	1.086	1573	.9749E-01	.1845E-02	40.50	36.85
28.85	1.134	1583	.1213E+00	.4774E-02	41.54	37.82
30.31	1.193	1595	.2837E+00	.1105E-01	42.77	38.92
31.99	1.263	1601	.5762E+00	.2268E-01	44.06	40.10
33.72	1.328	1604	.2603E+00	.1025E-01	45.01	41.96
34.52	1.358	1617	.4725E+00	.1858E-01	45.83	41.70
35.92	1.414	1613	.7445E+00	.1010E-01	46.92	42.70
37.45	1.474	1612	.7234E+00	.2834E-01	48.28	44.74
39.41	1.549	1615	.2102E+01	.8274E-01	50.62	46.17
41.81	1.725	1617				

TABLE D4-11

SPECIMEN NUMBER:			573-250-2			
ALLOY TYPE:			2024-T861			
SPECIMEN ORIENTATION:			TRANSVERSE			
CONSTRAINT:			UNSTIFFENED			
ENVIRONMENT:			WET AIR			
TEST TEMPERATURE:			297.3 K			
SPECIMEN THICKNESS:			6.35 MM (1/4 IN)			
MAXIMUM STRESS:			217.0 MPa (31.5 KSI)			
FREQUENCY:			2.0 CPS			
CYCLES TO FAILURE:			1403 CYCLES			
K(MAX)			37.37 MPa SQRT(IN) (33.67 KSI SQRT(IN))			
216 CYCLES PRIOR TO FAILURE:						
CRACK LENGTH			DELTA(A)/DELTA(N)	DELTA(Stress Intensity)		
MM	IN	CYCLES	MM/CYCLE	IN/CYCLE	MPa SQRT(IN)	KSI SQRT(IN)
3.53	.139	1	.1524E-02	.4018E-04	22.91	20.85
4.31	.170	512	.2744E-02	.1343E-03	25.64	23.33
5.51	.217	947	.3765E-02	.1442E-03	28.33	25.78
6.47	.245	1203	.4392E-02	.1774E-03	30.16	27.45
7.10	.280	1347	.4974E-02	.3537E-03	31.89	29.32
8.05	.317	1453	.8444E-02	.7374E-03	34.03	33.97
9.19	.362	1589				

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2024-T861 AND 2124-T851

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TABLE D4-12

SPECIMEN NUMBER: 279-280-2				279-280-2	
ALLOY TYPE: 2124-T861				2124-T861	
SPECIMEN ORIENTATION: TRANSVERSE				TRANSVERSE	
CONSTRAINT: UNSTIFFENED				UNSTIFFENED	
TEST TEMPERATURE: 650.0 K				650.0 K	
SPECIMEN THICKNESS: 6.34 MM (0.250 IN)				6.34 MM (0.250 IN)	
MAXIMUM STRESS: 326.3 MPA (47.1 KSI)				326.3 MPA (47.1 KSI)	
R-RATIO: 20				20	
FREQUENCY: 450 CYCLES				450 CYCLES	
CYCLES TO FAILURE: 55.51 MPA SQRT(IN) (50.52 KSI SQRT(IN))				55.51 MPA SQRT(IN) (50.52 KSI SQRT(IN))	
K(MAX): 2 CYCLES PRIOR TO FAILURE					
CRACK LENGTH MM IN		CYCLES	DELTA(A)/DELTA(IN) MM/CYCLE IN/CYCLE	DELTA(Stress Intensity) MPA SQRT(IN) KSI SQRT(IN)	
2.49	.198	1	.1810E-02	.7126E-04	28.44 25.88
2.87	.117	209	.8179E-02	.3229E-03	31.98 24.74
3.74	.147	315	.1398E-01	.5345E-03	35.25 32.04
4.49	.177	371	.2743E-01	.1388E-02	38.87 34.47
5.51	.217	437	.6199E-01	.2440E-02	42.51 34.48
6.44	.274	422	.4818E-01	.1897E-02	45.34 41.24
7.16	.282	437	.5114E-01	.2014E-02	47.14 42.90
7.52	.296	444	.2379E+00	.9350E-02	48.47 44.11
8.00	.319	446	.2392E+00	.9269E-02	51.00 46.41
9.17	.361	451			

TABLE D4-13

SPECIMEN NUMBER: 250-171				250-171	
ALLOY TYPE: 2024-T861				2024-T861	
SPECIMEN ORIENTATION: TRANSVERSE				TRANSVERSE	
CONSTRAINT: UNSTIFFENED				UNSTIFFENED	
TEST TEMPERATURE: 650.0 K				650.0 K	
SPECIMEN THICKNESS: 6.34 MM (0.250 IN)				6.34 MM (0.250 IN)	
MAXIMUM STRESS: 195.9 MPA (28.4 KSI)				195.9 MPA (28.4 KSI)	
R-RATIO: 20				20	
FREQUENCY: 450 CYCLES				450 CYCLES	
CYCLES TO FAILURE: 28.20 MPA SQRT(IN) (25.46 KSI SQRT(IN))				28.20 MPA SQRT(IN) (25.46 KSI SQRT(IN))	
K(MAX): 163 CYCLES PRIOR TO FAILURE					
CRACK LENGTH MM IN		CYCLES	DELTA(A)/DELTA(IN) MM/CYCLE IN/CYCLE	DELTA(Stress Intensity) MPA SQRT(IN) KSI SQRT(IN)	
2.92	.119	1	.2619E-02	.1370E-03	18.82 17.13
3.59		255	.5833E-02	.1942E-03	20.64 14.82
4.27	.168	391	.4743E-02	.1867E-03	22.54 23.51
5.06	.199	557	.1011E-01	.7979E-03	24.31 22.12
5.79	.228	629	.1104E-01	.4347E-03	25.96 23.63
6.48	.259	701			

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TABLE D4-14

SPECIMEN NUMBER: 202-272		202-272		202-272	
ALLOY TYPE: 2024-T061		2024-T061		2024-T061	
SPECIMEN ORIENTATION: TRANSVERSE		TRANSVERSE		TRANSVERSE	
CONSTRAINT: UNSTRESSING		UNSTRESSING		UNSTRESSING	
TEST TEMPERATURE: 100 °F		100 °F		100 °F	
SPECIMEN THICKNESS: 0.10 IN		0.10 IN		0.10 IN	
MAXIMUM STRESS: 372.4 MPa (53.9 KSI)		372.4 MPa (53.9 KSI)		372.4 MPa (53.9 KSI)	
CYCLES TO FAILURE: 16 CYCLES		16 CYCLES		16 CYCLES	
K(MAX): 3 CYCLES PRIOR TO FAILURE		(NET STRESS GREATER THAN 1.9 PVV)			
CRACK LENGTH		DELTA(A)/DELTA(N)		DELTA(STRESS INTENSITY)	
MM	IN	MM/CYCLE	IN/CYCLE	MPa SORT(M)	KSI SORT(IN)
17.47	.689	.9324E-01	.1671E-01	56.14	51.11

TABLE D4-15

SPECIMEN NUMBER: 202-276		202-276		202-276	
ALLOY TYPE: 2024-T061		2024-T061		2024-T061	
SPECIMEN ORIENTATION: TRANSVERSE		TRANSVERSE		TRANSVERSE	
CONSTRAINT: UNSTRESSING		UNSTRESSING		UNSTRESSING	
TEST TEMPERATURE: 100 °F		100 °F		100 °F	
SPECIMEN THICKNESS: 0.10 IN		0.10 IN		0.10 IN	
MAXIMUM STRESS: 118.6 MPa (17.2 KSI)		118.6 MPa (17.2 KSI)		118.6 MPa (17.2 KSI)	
CYCLES TO FAILURE: 1674 CYCLES		1674 CYCLES		1674 CYCLES	
K(MAX): 112 CYCLES PRIOR TO FAILURE		39.68 MPa SORT(M); 36.11 KSI SORT(IN)			
CRACK LENGTH		DELTA(A)/DELTA(N)		DELTA(STRESS INTENSITY)	
MM	IN	MM/CYCLE	IN/CYCLE	MPa SORT(M)	KSI SORT(IN)
9.84	.358	.1361E-02	.1559E-03	19.53	17.74
4.99	.193	.3728E-02	.1468E-03	20.33	18.56
10.62	.418	.6339E-02	.2499E-03	20.79	19.10
11.33	.446	.6445E-02	.1753E-03	21.64	19.70
12.00	.473	.7501E-02	.2945E-03	22.31	20.30
12.75	.502	.7767E-02	.3053E-03	22.96	21.49
13.44	.529	.1037E-01	.4002E-03	23.74	21.60
14.52	.572	.1515E-01	.5466E-03	24.58	22.17
15.42	.607	.1336E-01	.5248E-03	25.47	23.16
16.66	.646	.1559E-01	.6117E-03	26.20	23.42
17.45	.687	.1723E-01	.6743E-03	26.91	24.69
18.24	.718	.2084E-01	.9274E-03	27.44	24.97
19.81	.740	.2314E-01	.9112E-03	28.12	25.77
20.57	.710	.3311E-01	.1303E-02	29.34	26.73
21.66	.853	.3159E-01	.1242E-02	30.34	27.63
23.33	.917	.4568E-01	.1749E-02	31.51	28.67
24.90	.983	.5429E-01	.2177E-02	32.64	29.70
26.50	1.048	.5697E-01	.2243E-02	33.74	30.71
28.18	1.109	.6218E-01	.2448E-02	34.81	31.72
29.86	1.175	.7275E-01	.2844E-02	35.71	32.51
31.67	1.215	.8244E-01	.3247E-02	36.54	33.16
32.44	1.277	.9121E-01	.3591E-02	37.37	34.01
33.44	1.317				

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TABLE D4-16

SPECIMEN NUMBER: 214-283-1
ALLOY TYPE: 2124-T851
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINT: UNSTIFFENED
FUNDAMENTAL: LRP 10
TEST TEMPERATURE: 49.1 K
SPECIMEN THICKNESS: 6.41 MM (0.252 IN)
MAXIMUM STRESS: 109.1 MPa (15.8 KSI)
FREQUENCY: 11967 CYCLES
CYCLES TO FAILURE: 677
K(MAN): 677 CYCLES PRIOR TO FAILURE
53.86 MPa (SPT(M)) 49.1 KSI (SPT(M))

CRACK LENGTH MM	IN	CYCLES	DELTA(KIAS)/DELTA(IN) MPa/CYCLE	IN/CYCLE	DELTA(STRESS INTENSITY) MPa SQR(T)/CYCLE	KSI SQR(T)/CYCLE
10.52	.418	1	.9712E-33	.3436E-04	18.40	17.11
10.45	.427	9.0	.1153E-02	.4531E-04	19.43	17.48
11.44	.451	1459	.1153E-02	.4145E-04	20.32	18.22
12.70	.490	2184	.1153E-02	.5347E-04	20.40	18.75
12.41	.494	2831	.1160E-02	.5189E-04	21.13	19.23
13.47	.530	3119	.1415E-02	.5571E-04	21.72	19.76
14.25	.561	3671	.1401E-02	.5423E-04	22.23	20.23
14.76	.581	4034	.1625E-02	.6197E-04	22.66	20.62
15.76	.605	4799	.1349E-02	.5390E-04	23.09	21.02
16.90	.626	4736	.2224E-02	.8757E-04	23.61	21.47
16.74	.659	5174	.1936E-02	.7622E-04	24.14	21.97
17.14	.683	9481	.1337E-02	.1329E-03	24.67	22.45
18.70	.717	5717	.2561E-02	.1009E-03	25.14	23.06
19.21	.756	6132	.2701E-02	.1054E-03	26.18	23.83
20.02	.782	6855	.3157E-02	.1247E-03	27.25	24.80
22.11	.881	7238	.3637E-02	.1432E-03	28.32	25.77
23.47	.940	7619	.4374E-02	.1722E-03	29.78	26.65
25.17	.999	7961	.4587E-02	.1806E-03	30.10	27.65
27.34	1.078	8319	.5667E-02	.2231E-03	31.47	28.64
28.88	1.137	8665	.5586E-02	.2199E-03	32.28	29.18
30.06	1.194	8876	.7577E-02	.3022E-03	32.10	29.44
30.95	1.219	9432	.5687E-02	.2605E-03	33.56	30.53
32.48	1.269	9147	.6650E-02	.2618E-03	34.10	31.21
33.48	1.318	9371				
35.01	1.379	9856	.7545E-02	.3131E-03	35.11	31.55
36.71	1.445	9732	.1021E-01	.1021E-03	36.05	32.40
38.62	1.516	9961	.7501E-02	.3111E-03	37.16	33.72
40.39	1.578	10080	.1176E-01	.4828E-03	38.01	34.61
41.64	1.636	10203	.1277E-01	.5004E-03	38.89	35.39
42.49	1.680	10291	.1297E-01	.5104E-03	39.63	36.07
43.12	1.704	10386	.1381E-01	.5053E-03	40.10	36.88
45.22	1.740	10476	.1473E-01	.5794E-03	41.33	37.34
46.95	1.836	10574	.1421E-01	.5595E-03	41.41	38.05
47.31	1.887	10664	.1541E-01	.6467E-03	42.50	38.76
48.68	1.948	10733	.1561E-01	.7722E-03	43.40	39.50
50.68	1.995	10817	.1625E-01	.6349E-03	44.10	40.22
52.14	2.053	10977	.2000E-01	.8229E-03	44.47	40.92
53.28	2.097	10945	.1564E-01	.6471E-03	45.77	41.61
54.47	2.145	10998	.2421E-01	.1117E-02	46.40	42.23
56.48	2.214	11045	.1767E-01	.6939E-03	47.06	42.92
56.68	2.232	11113	.2025E-01	.8134E-03	47.71	43.62
58.11	2.248	11139	.2549E-01	.1004E-02	48.60	44.14
58.44	2.300	11212	.2500E-01	.9865E-03	49.13	44.98
60.40	2.378	11253	.2875E-01	.1117E-02	50.19	45.59
61.76	2.431	11273	.2905E-01	.1146E-02	50.91	46.24

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TABLE D4-17

SPECIMEN NUMBER: 178-258-3						
ALLOY TYPE: 2024-T861						
SPECIMEN ORIENTATION: TRANSVERSE						
ENVIRONMENT: UNSTRESSING						
TEST TEMPERATURE: 100 °F						
SPECIMEN THICKNESS: 5.38 MM (0.211 IN)						
MAXIMUM STRESS: 217.2 MPa (31.5 KSI)						
R-RATIO: 0.25						
FREQUENCY: 20 CPS						
CYCLES TO FAILURE: 2073 CYCLES						
1 CYCLES PRIOR TO FAILURE: 89.16 MPa SORT(M); 81.14 KSI SORT(M)						
CRACK LENGTH	MM	IN	CYCLES	DELTA (A)/DELTA (IN)	DELTA STRESS INTENSITY	
2.58	.101			MM/CYCLE	MPa SORT(M)	KSI SORT(M)
3.16	.124		529	.1106E-02	.4356E-04	19.59
3.81	.150		935	.1589E-02	.6296E-04	21.59
4.42	.174		1228	.2089E-02	.8225E-04	23.46
4.96	.195		1437	.3030E-02	.1193E-03	25.06
6.06	.238		1663	.4276E-02	.1684E-03	27.17
6.77	.267		1810	.4864E-02	.1915E-03	29.32
7.42	.292		1889	.8353E-02	.3288E-03	30.85
8.01	.316		1977	.6664E-02	.2624E-03	32.18
8.94	.352		2093	.7937E-02	.3129E-03	33.74
9.89	.382		2176	.9389E-02	.3578E-03	35.38
10.63	.416		2253	.1268E-01	.4993E-03	36.97
11.34	.446		2308	.1220E-01	.4832E-03	38.46
11.99	.472		2343	.2748E-01	.8063E-03	39.65
12.65	.498		2395	.1208E-01	.4745E-03	40.77
13.40	.528		2437	.1472E-01	.7763E-03	41.94
14.00	.551		2483	.2502E-01	.7883E-03	43.04
F	17.27	.682	2567	.3142E-01	.1237E-02	46.05
F	19.18	.755	2625	.3284E-01	.1293E-02	49.83
F	20.83	.823	2667	.3431E-01	.1544E-02	52.31
F	21.97	.865	2697	.3810E-01	.1500E-02	54.19
F	23.37	.920	2724	.5174E-01	.2037E-02	55.87
F	24.76	.978	2737	.1075E+00	.4231E-02	57.67
F	26.84	1.055	2771	.5075E-01	.2353E-02	58.84
F	28.32	1.115	2784	.1172E+00	.4615E-02	62.03
F	29.57	1.145	2793	.1467E-01	.1333E-02	63.73
F	31.88	1.254	2814	.1524E+00	.6400E-02	65.86
F	33.15	1.315	2824	.1271E+00	.8300E-02	67.96
F	35.31	1.390	2834	.3153E-01	.1530E-02	69.06
F	38.86	1.530	2854	.1779E+00	.7300E-02	73.26
F	41.51	1.645	2853	.3700E+00	.1310E-01	76.24
F	43.65	1.715	2864	.5040E+00	.2000E-01	78.63
F	46.34	1.785	2867	.4527E+00	.1801E-01	81.37
F	47.17	1.855	2872	.5920E+00	.2333E-01	83.64

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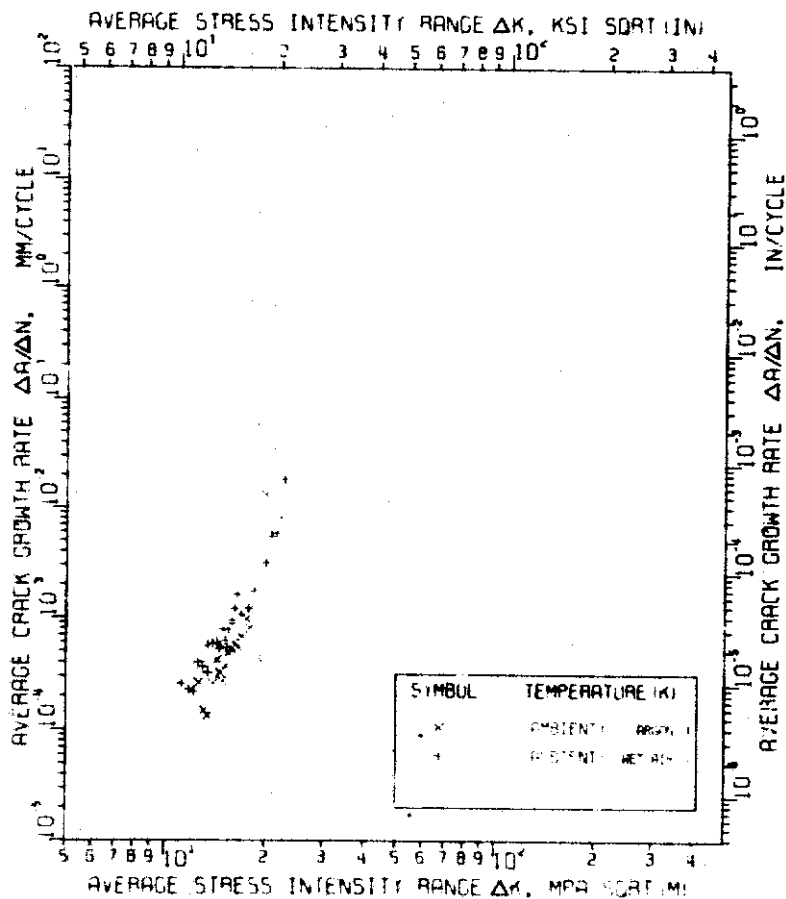
FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

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TABLE D4-18

SPECIMEN NUMBER1				S75-259-1		
S75-259-1				2124-T851		
S75-259-1				TRANSVERSE		
S75-259-1				UNSTRESSING		
S75-259-1				LAD 816		
S75-259-1				5.94 MM (234.0 IN)		
S75-259-1				307.6 MPA (44.6 KSI)		
S75-259-1				899 20 CM		
S75-259-1				CYCLES		
S75-259-1				(NET STRESS GREATER THAN 0.9 FTY)		
S75-259-1				1 CYCLES PRIOR TO FAILURE		
CRACK LENGTH	IN	CYCLES	DELTA S (A)/DELTA IN	DELTA STRESS	INTENSITY	
MM			MM/CYCLE	MPA (KSI)	FTY (KSI)	
2.96	.121	1	.2635E-02	.1037E-03	27.54	25.86
3.09	.122	202	.4824E-02	.1899E-03	38.38	27.65
3.79	.149	346	.6578E-02	.2747E-03	33.19	37.21
4.42	.174	437	.7108E-02	.2877E-03	35.94	32.70
5.28	.205	543	.1567E-01	.6171E-03	32.42	34.96
5.79	.228	581	.1952E-01	.6111E-03	48.39	36.76
6.35	.258	617	.1226E-01	.4825E-03	42.98	38.68
7.09	.279	677	.2328E-01	.9133E-03	44.72	40.70
7.74	.306	787	.2203E-01	.8988E-03	47.16	42.92
8.74	.344	749	(NET STRESS GREATER THAN 0.9 FTY)			
9.57	.377	766	(NET STRESS GREATER THAN 0.9 FTY)			
10.74	.407	788	(NET STRESS GREATER THAN 0.9 FTY)			
13.69	.421	881	(NET STRESS GREATER THAN 0.9 FTY)			
10.96	.431	889	(NET STRESS GREATER THAN 0.9 FTY)			
12.28	.483	819	(NET STRESS GREATER THAN 0.9 FTY)			
F 18.88	.740	849	(NET STRESS GREATER THAN 0.9 FTY)			
F 20.32	.800	859	(NET STRESS GREATER THAN 0.9 FTY)			
F 22.48	.885	869	(NET STRESS GREATER THAN 0.9 FTY)			
F 25.48	1.000	879	(NET STRESS GREATER THAN 0.9 FTY)			
F 27.43	1.088	887	(NET STRESS GREATER THAN 0.9 FTY)			
F 31.50	1.240	893	(NET STRESS GREATER THAN 0.9 FTY)			
F 35.18	1.385	896	(NET STRESS GREATER THAN 0.9 FTY)			
F 38.35	1.510	897	(NET STRESS GREATER THAN 0.9 FTY)			
F 41.02	1.615	898	(NET STRESS GREATER THAN 0.9 FTY)			

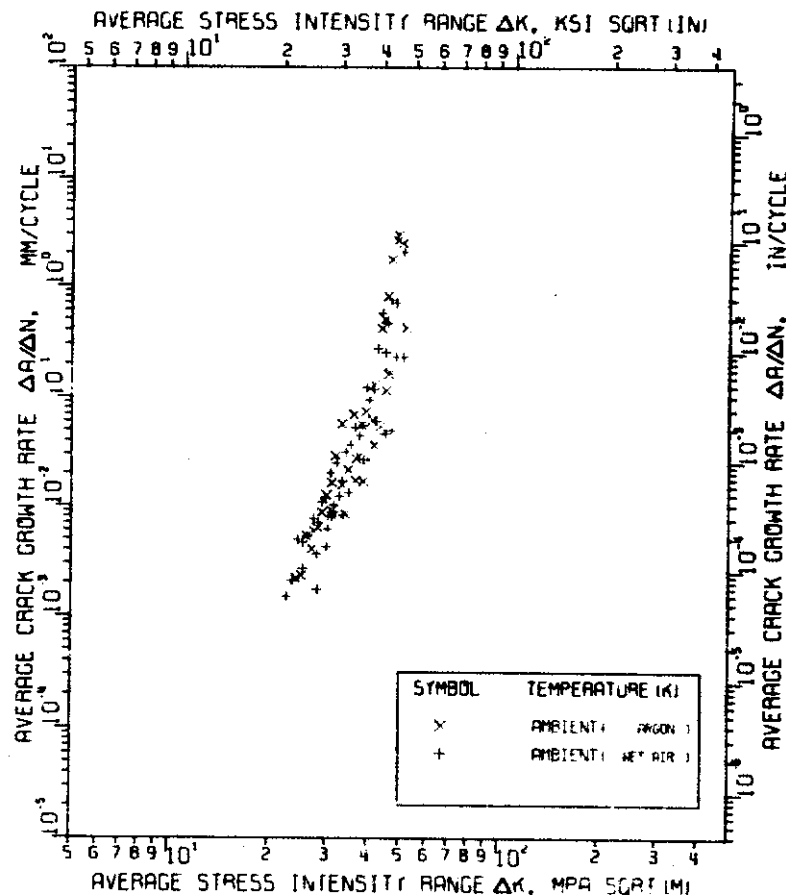
(a) Transverse, 2024-T861



Thickness: 6.35 mm (.250 inch)

Constraint: Unstiffened

(b) Transverse, 2124-T851

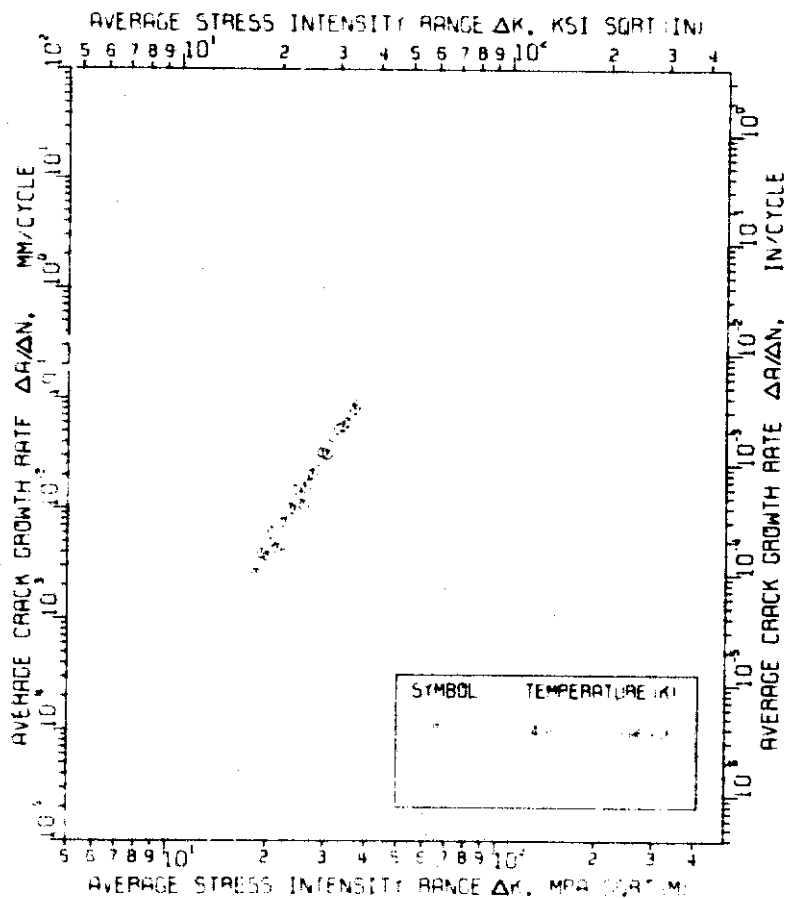


Stress Ratio: .05

Frequency: 20 cpm

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

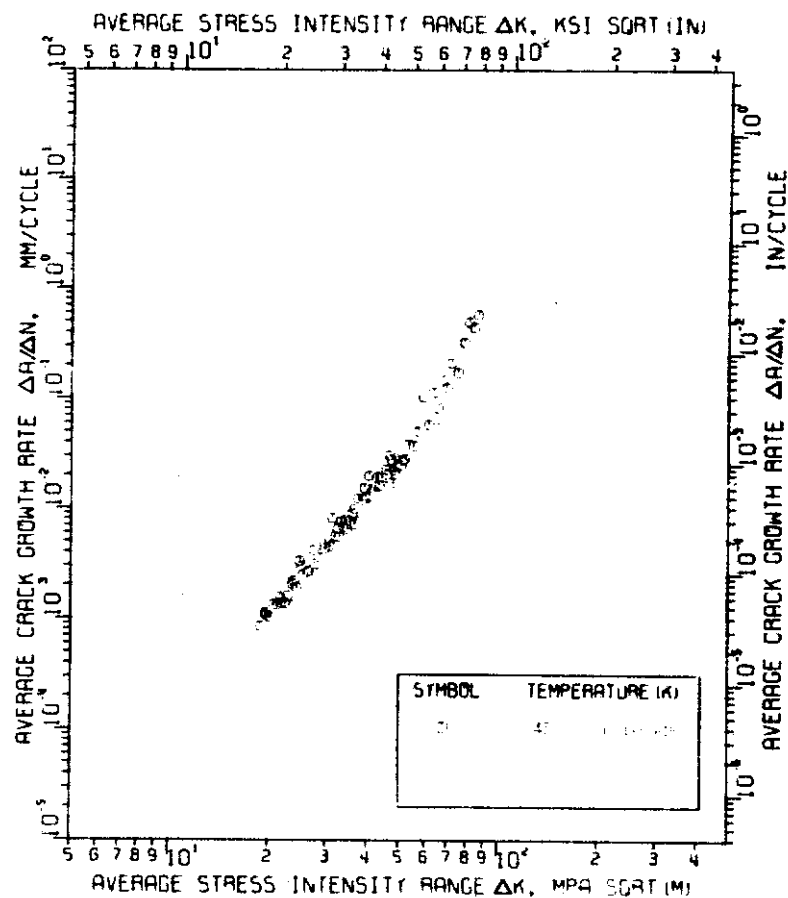
(a) Transverse, 2024-T861



Thickness: 6.35 mm (.250 inch)

Constraint: Unstiffened

(b) Transverse, 2124-T851



Stress Ratio: .05

Frequency: 200 cpm

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

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**FRACTURE MECHANICS DATA FOR
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**SECTION D5 - - FLAW GROWTH RATE DATA
FOR 6.35 mm (.250 INCH) THICK 2124-T851**

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TABLE D5-1. SUMMARY OF SPECIMEN TEST CONDITIONS FOR 200 CPM TESTS OF
6.35 mm (.250 INCH) THICK 2124-T851

<u>Test Temperature (°K)</u>	<u>Stress Ratio</u>	<u>Test Direction</u>	<u>Specimen I.D.</u>	<u>Data Table No.</u>	<u>Figure No.</u>	
144 (N ₂)	.05	L	2L2-256-1	D5-2	D5-1(a)	
			3L2-259-2	D5-3	D5-1(a)	
		T	2T3-256-1	D5-4	D5-1(b)	
			2T1-259-1	D5-5	D5-1(b)	
	.50	L	3L1-253-1	D5-6	D5-2(a)	
			2L1-256-3	D5-7	D5-2(a)	
			3L2-259-3	D5-8	D5-2(a)	
		T	2T1-259-3	D5-9	D5-2(b)	
			1T6-256-2	D5-10	D5-2(b)	
			1T1-253-3	D5-11	D5-2(b)	
	298 (Argon)	.05	L	3L1-253-3	D5-12	D5-3(a)
				1L2-256-1	D5-13	D5-3(a)
3L7-259-1				D5-14	D5-3(a)	
T			2T4-253-2	D5-15	D5-3(b)	
			1T8-256-1	D5-16	D5-3(b)	
			2T4-259-3	D5-17	D5-3(b)	
.50		L	1L1-253-3	D5-18	D5-4(a)	
			2L3-256-3	D5-19	D5-4(a)	
			1L3-259-1	D5-20	D5-4(a)	
		T	3T5-253-4	D5-21	D5-4(b)	
			3T3-256-3	D5-22	D5-4(b)	
			3T8-259-1	D5-23	D5-4(b)	
298 (Wet Air)	.05	L	2L2-253-4	D5-24	D5-3(a)	
			3L3-256-1	D5-25	D5-3(a)	
			1L3-259-2	D5-26	D5-3(a)	
		T	3T5-253-3	D5-27	D5-3(b)	
			5T5-259-2	D5-28	D5-3(b)	
		.50	L	3L1-253-2	D5-29	D5-4(a)
	1L2-256-2			D5-30	D5-4(a)	
	5L5-259-2			D5-31	D5-4(a)	
	T		2T7-253-1	D5-32	D5-4(b)	
			5T2-256-1	D5-33	D5-4(b)	
			1T8-256-3	D5-34	D5-4(b)	
			1T4-259-1	D5-35	D5-4(b)	

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FRACTURE MECHANICS DATA FOR
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TABLE D5-1. (CONTINUED)

<u>Test Temperature (°K)</u>	<u>Stress Ratio</u>	<u>Test Direction</u>	<u>Specimen I. D.</u>	<u>Data Table No.</u>	<u>Figure No.</u>
422	.05	L	1L1-253-1	D5-36	D5-5(a)
		T	3T5-253-1	D5-37	D5-5(b)
450	.05	L	2L2-253-2	D5-38	D5-5(a)
			3L3-256-2	D5-39	D5-5(a)
			4L3-259-2	D5-40	D5-5(a)
		T	2T4-253-3	D5-41	D5-5(b)
			3T3-256-1	D5-42	D5-5(b)
			2T6-259-1	D5-43	D5-5(b)
	.50	L	2L3-256-2	D5-44	D5-6(a)
			4L3-259-3	D5-45	D5-6(a)
478		T	2T3-256-3	D5-46	D5-6(b)
			2T1-259-2	D5-47	D5-6(b)
		L	1L1-253-4	D5-48	D5-5(a)
	.05	T	2T4-253-4	D5-48	D5-5(a)
				D5-49	D5-5(b)

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FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

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TABLE D5-2

SPECIMEN NUMBER					
SPECIMEN ORIENTATION					
TEST TEMPERATURE					
SPECIMEN THICKNESS					
MAXIMUM STRESS					
CYCLES TO FAILURE					
K(MAX)					
1 CYCLES PRIOR TO FAILURE					
113.06 MPA SQR(T(M)) (102.89 KSI SQR(T(IN)))					
CRACK LENGTH	IN	CYCLES	DELTA(I)/DELTA(II)	DELTA(II)/DELTA(I)	DELTA(II)/DELTA(I)
MM					
4.04	.159	1	.7604E-03	.2994E-04	23.79
4.41	.174	482	.8167E-03	.3216E-04	24.93
4.87	.192	1044	.1372E-02	.5401E-04	27.11
6.10	.240	1945	.6382E-02	.2513E-03	29.48
6.06	.270	2064	.4999E-02	.1968E-03	31.36
7.00	.307	2252	.2641E-02	.1040E-03	33.11
8.54	.336	2533	.3591E-02	.1414E-03	34.27
9.06	.357	2675	.7427E-02	.2924E-03	35.91
10.13	.399	2723	.7518E-02	.2900E-03	37.52
10.79	.425	2907	.1006E-01	.3961E-03	38.68
11.43	.450	2971	.1114E-01	.4388E-03	39.72
11.98	.472	3023	.2333E-01	.9186E-03	41.88
12.79	.504	3055	.1514E-01	.5961E-03	42.50
13.94	.549	3131	.1123E-01	.4423E-03	43.77
14.38	.566	3173	.1138E-01	.4480E-03	44.34
14.67	.577	3195	.2204E-01	.8696E-03	44.95
15.18	.597	3218	.1964E-01	.7356E-03	45.94
16.02	.631	3263	.2664E-01	.1040E-02	47.45
17.13	.675	3395	.2216E-01	.8725E-03	48.59
17.58	.692	3325	.9584E-01	.3775E-02	50.14
F 19.30	.756	3347	.4762E-01	.1875E-02	53.96
F 21.11	.911	3423	.3255E-01	.3250E-02	57.51
F 24.76	.975	3443	.1016E+00	.4030E-02	59.52
F 26.29	1.035	3458	.1524E+00	.6031E-02	61.41
F 27.81	1.095	3468	.2393E+00	.9444E-02	63.66
F 29.97	1.181	3477	.6391E+00	.2503E-01	66.46
F 32.51	1.240	3481	.5352E+00	.2532E-01	68.45
F 35.05	1.380	3485	.1216E+01	.4757E-01	72.31
F 37.46	1.475	3487	.1651E+01	.6503E-01	74.65
F 39.12	1.540	3494	.1175E+01	.1240E+00	77.47
F 42.29	1.665	3489	.2921E+01	.1150E+00	91.87
F 45.21	1.742	3493	.2921E+01	.1150E+00	94.20
F 48.13	1.895	3491	.1791E+02	.7350E+00	96.31
F 50.04	2.020	3492			

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FRACTURE MECHANICS DATA FOR
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TABLE D5-3

SPECIMEN NUMBER: 3L2-259-2				2124-T851		
ALLOY TYPE: 2124-T851				LONGITUDINAL		
SPECIMEN ORIENTATION: UNSTRESS				NITROGEN		
ENVIRONMENT: NITROGEN				144.8 K		
TEST TEMPERATURE: 144.8 K				6.32 MM (1.248 IN)		
SPECIMEN THICKNESS: 6.32 MM (1.248 IN)				320.6 MPA (46.5 KSI)		
MAXIMUM STRESS: 320.6 MPA (46.5 KSI)				230 CMH		
FREQUENCY: 230 CMH				230 CYCLES		
CYCLES TO FAILURE: 2351				92.46 MPA SQRT(MM) (84.16 KSI SQRT(IN))		
K(MAX): 2 CYCLES PRIOR TO FAILURE						
CRACK LENGTH MM IN		CYCLES I	DELTA(I)/DELTA(M) MM/CYCLE IN/CYCLE	DELTA(II)/DELTA(M) MM/CYCLE IN/CYCLE	DELTA(III)/DELTA(M) MM/CYCLE IN/CYCLE	DELTA(IV)/DELTA(M) MM/CYCLE IN/CYCLE
2.56	.101		.9212E-03	.3627E-04	28.65	26.08
3.00	.121	569	.1720E-02	.6771E-04	32.08	29.20
3.98	.157	1096	.2506E-02	.1144E-03	35.74	32.53
4.78	.188	1768	.2132E-02	.8393E-04	34.14	34.71
5.20	.205	1964	.5245E-02	.2065E-03	40.35	36.72
5.98	.235	1710	.5554E-02	.2187E-03	43.23	39.34
6.84	.269	1868	.8993E-02	.3540E-03	41.14	41.99
7.73	.304	1967	.9825E-02	.3553E-03	46.57	44.20
8.41	.331	2047	.1292E-01	.5080E-03	50.35	45.82
8.92	.351	2042	.1258E-01	.4951E-03	52.02	47.34
9.56	.377	2133	.2489E-01	.9486E-03	54.12	49.26
10.43	.411	2169	.1607E-01	.6320E-03	55.99	50.95
10.95	.431	2201	.2632E-01	.9969E-03	57.72	52.53
11.76	.463	2233	.2515E-01	.1148E-02	55.49	54.14
12.34	.486	2253	.4397E-01	.1731E-02	62.89	57.24
14.54	.572	2303	.4972E-01	.1880E-02	66.00	60.06
14.99	.598	2313	.1135E+00	.4478E-02	67.00	61.78
16.13	.635	2323	.9292E-01	.3658E-02	69.67	63.41
16.69	.657	2329	.1643E+00	.6460E-02	72.22	65.73
18.58	.728	2340	.2074E+00	.1132E-01	75.90	69.07
20.22	.796	2344	.1068E+01	.4175E-01	82.85	75.48
25.92	1.085	2351				

TABLE D5-4

SPECIMEN NUMBER: 3L2-259-1				2124-T851		
ALLOY TYPE: 2124-T851				TRANSVERSE		
SPECIMEN ORIENTATION: UNSTRESS				NITROGEN		
ENVIRONMENT: NITROGEN				144.8 K		
TEST TEMPERATURE: 144.8 K				6.50 MM (1.248 IN)		
SPECIMEN THICKNESS: 6.50 MM (1.248 IN)				217.2 MPA (31.5 KSI)		
MAXIMUM STRESS: 217.2 MPA (31.5 KSI)				208 CMH		
FREQUENCY: 208 CMH				1423 CYCLES		
CYCLES TO FAILURE: 1411				46.62 MPA SQRT(MM) (44.25 KSI SQRT(IN))		
K(MAX): 12 CYCLES PRIOR TO FAILURE						
CRACK LENGTH MM IN		CYCLES I	DELTA(I)/DELTA(M) MM/CYCLE IN/CYCLE	DELTA(II)/DELTA(M) MM/CYCLE IN/CYCLE	DELTA(III)/DELTA(M) MM/CYCLE IN/CYCLE	DELTA(IV)/DELTA(M) MM/CYCLE IN/CYCLE
3.85	.152		.1679E-02	.6609E-04	23.64	21.51
4.49	.177	361	.2352E-02	.9259E-04	25.55	23.29
5.25	.207	704	.4619E-02	.1818E-03	27.74	25.25
6.23	.245	916	.2977E-02	.1172E-03	29.35	26.71
6.61	.260	1044	.6768E-02	.2665E-03	30.38	27.65
7.15	.281	1123	.1165E-01	.4546E-03	31.77	29.91
7.89	.311	1187	.1234E-01	.4872E-03	33.69	30.86
9.01	.355	1277	.2611E-01	.1228E-02	35.86	32.58
10.65	.416	1317	.2111E-01	.4313E-03	37.24	33.89
10.56	.416	1341	.3015E-01	.1522E-02	39.39	35.85
12.47	.491	1391	.1135E+00	.4468E-02	42.05	38.27
13.71	.540	1402	.2244E+00	.8873E-02	44.65	40.64
15.73	.619	1411				

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TABLE D5-5

SPECIMEN NUMBER: 271-299-1			
ALLOY TYPE: 2024-T861			
SPECIMEN ORIENTATION: LONGITUDINAL			
CONSTRAINT: UNSTRESSING			
ENVIRONMENT: NITROGEN			
TEST TEMPERATURE: 100.0 K			
SPECIMEN THICKNESS: 6.14 MM (240.0 IN)			
SPECIMEN WIDTH: 368.2 MPa (51.8 KSI)			
FREQUENCY: 200 CPS			
CYCLES TO FAILURE: 188 CYCLES			
KIMAX: 1 CYCLES PRIOR TO FAILURE: 54.16 MPa (SORTIM): 49.29 KSI (SORTIM)			
CRACK LENGTH MM IN	CYCLES	DELTA(KI)/DELTA(IN) MM/CYCLE IN/CYCLE	DELTA(Stress Intensity) MPa (SORTIM) KSI (SORTIM)
2.38 .091	1	.4697E-02 .1833E-03	29.55 28.89
2.58 .102	61	.1424E-01 .8687E-03	33.38 38.38
3.69 .144	136	.6279E-01 .2472E-02	38.84 35.36
4.78 .188	156	.1491E+00 .7444E-02	44.53 48.52
6.29 .248	162	.1489E+00 .6698E-02	48.12 43.79
6.63 .261	164	.7493E+00 .2958E-01	58.11 45.60
F 7.38 .290	183		

TABLE D5-6

SPECIMEN NUMBER: 311-291-1			
ALLOY TYPE: 2124-T851			
SPECIMEN ORIENTATION: LONGITUDINAL			
CONSTRAINT: UNSTRESSING			
ENVIRONMENT: NITROGEN			
TEST TEMPERATURE: 100.0 K			
SPECIMEN THICKNESS: 6.50 MM (256.0 IN)			
SPECIMEN WIDTH: 168.7 MPa (23.9 KSI)			
FREQUENCY: 200 CPS			
CYCLES TO FAILURE: 2565 CYCLES			
KIMAX: 319 CYCLES PRIOR TO FAILURE: 61.84 MPa (SORTIM): 58.19 KSI (SORTIM)			
CRACK LENGTH MM IN	CYCLES	DELTA(KI)/DELTA(IN) MM/CYCLE IN/CYCLE	DELTA(Stress Intensity) MPa (SORTIM) KSI (SORTIM)
7.11 .276	1	.1919E-03 .7755E-05	12.21 11.11
7.66 .302	3629	.2454E-03 .9674E-05	12.96 11.79
9.91 .388	9143	.3164E-03 .1247E-04	13.80 17.56
9.46 .368	11429	.3491E-03 .1375E-04	14.41 13.11
17.95 .693	13264	.3854E-03 .1439E-04	14.44 13.52
18.13 .718	14991	.7474E-03 .2942E-04	15.11 13.93
11.91 .465	15895	.5317E-03 .2093E-04	15.70 14.29
12.11 .485	16844	.5144E-03 .2104E-04	16.00 14.56
12.71 .510	17547	.1249E-02 .4133E-04	16.37 14.45
13.11 .525	18172	.1083E-02 .4267E-04	16.79 15.28
14.14 .558	18949	.1245E-02 .6516E-04	17.26 14.71
14.04 .555	19774	.1173E-02 .4604E-04	17.70 16.11
15.85 .616	20257	.2033E-02 .8037E-04	18.27 16.57
16.56 .652	20498	.1643E-02 .6549E-04	18.69 17.01
17.34 .683	20966	.2117E-02 .8333E-04	19.07 17.36
17.91 .705	21236	.2421E-02 .9532E-04	19.41 17.86
18.56 .731	21511	.2624E-02 .1151E-03	19.85 18.06
19.51 .768	21827	.3531E-02 .1540E-03	23.54 18.71
21.24 .815	22258	.3499E-02 .1374E-03	21.14 19.46
22.67 .893	22675	.5195E-02 .2321E-03	22.45 20.22
23.63 .930	22841	.4234E-02 .1655E-03	22.49 20.47
24.45 .970	23043	.5497E-02 .2322E-03	23.84 21.00
26.00 1.024	23317	.6124E-02 .2373E-03	23.77 21.57
27.23 1.072	23517		
28.61 1.117	23724	.8404E-02 .2682E-03	24.31 22.14
30.13 1.186	23927	.7567E-02 .2973E-03	25.31 22.76
31.28 1.211	24150	.8632E-02 .3394E-03	26.63 23.33
33.61 1.284	24204	.9890E-02 .3582E-03	28.70 23.85
34.62 1.355	24478	.6472E-02 .2627E-03	28.37 24.90
36.56 1.430	24730	.1411E-01 .3996E-03	27.59 24.11
37.19 1.464	24655	.1594E-01 .6793E-03	28.48 26.29
38.41 1.512	24741	.1261E-01 .4140E-03	26.52 26.87
41.21 1.613	24913	.1337E-01 .5147E-03	30.24 27.53
41.59 1.641	25025	.2314E-01 .9113E-03	10.94 28.16
43.17 1.707	25094	.7745E-01 .1089E-02	21.62 28.78
44.72 1.751	25147		

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TABLE D5-7

SPECIMEN NUMBER: 21-296-3						
SPECIMEN ORIENTATION: LONGITUDINAL						
CONSTRAINT: UNSTRESS						
TEST TEMPERATURE: 4.48 MM (1.76 IN) X						
SPECIMEN THICKNESS: 257.3 MPA (37.2 KSI)						
HASTROP STRESS: 257.3 MPA (37.2 KSI)						
FREQUENCY: 200 CPS						
CYCLES TO FAILURE: 95.48 MPA SORTIME (66.02 KSI SORTIME)						
(MIN) 1 CYCLES PRIOR TO FAILURE						
CRACK LENGTH	CYCLES	DELTA(I)/DELTA(II)	DELTA(II)/DELTA(III)	DELTA(III)/DELTA(IV)	DELTA(IV)/DELTA(V)	DELTA(V)/DELTA(VI)
MM	1	MM/CYCLE	IN/CYCLE	PPA SORTIME	KSI SORTIME	
6.00	274	.0049E-03	.2300E-04	16.44	14.06	
7.60	299	.1327E-02	.5216E-04	17.25	15.70	
8.43	332	.1122E-02	.4419E-04	18.02	16.39	
9.04	356	.1054E-02	.4010E-04	18.67	16.99	
9.71	382	.2451E-02	.1162E-03	19.31	17.57	
10.34	407	.1710E-02	.6733E-04	19.74	17.96	
10.99	417	.2101E-02	.8273E-04	20.27	18.48	
F 11.67	451	.3302E-02	.1300E-03	21.12	19.22	
F 12.40	471	.4191E-02	.1650E-03	22.11	20.12	
F 13.72	548	.5100E-02	.2000E-03	23.10	21.00	
F 14.99	590	.4445E-02	.1750E-03	24.05	21.80	
F 15.87	623	.4090E-02	.3500E-03	25.10	22.64	
F 17.45	695	.7620E-02	.3000E-03	26.21	23.00	
F 18.00	740	.1143E-01	.4500E-03	27.05	24.62	
F 19.44	785	.1429E-01	.5620E-03	27.80	25.37	
F 21.01	830	.2117E-01	.8333E-03	28.73	26.14	
F 22.35	880	.1524E-01	.6000E-03	29.43	26.78	
F 23.11	910	.2222E-01	.8750E-03	29.99	27.29	
F 24.30	965	.3175E-01	.1250E-02	30.72	27.95	
F 25.27	995	.4233E-01	.1667E-02	31.95	28.72	
F 26.54	1.045	.3810E-01	.1500E-02	32.22	29.32	
F 27.30	1.075	.4890E-01	.3500E-02	33.03	30.06	
F 29.08	1.145	.8467E-01	.3333E-02	34.00	30.94	
F 30.35	1.195					
F 32.00	1.260	.1051E+00	.6500E-02	34.92	31.70	
F 33.53	1.320	.1524E+00	.4000E-02	35.90	32.87	
F 35.91	1.415	.2540E+00	.1000E-01	37.07	33.73	
F 36.73	1.445	.2222E+00	.8750E-02	38.03	34.61	
F 37.05	1.490	.3410E+00	.1500E-01	38.45	35.17	
F 39.37	1.550	.5000E+00	.2000E-01	39.45	35.90	
F 40.04	1.610	.7620E+00	.3000E-01	40.37	36.73	
F 44.07	1.735	.3175E+01	.1250E+00	41.77	38.01	
F 45.97	1.810	.1505E+01	.7500E-01	43.29	39.40	
F 52.32	2.060	.6390E+01	.2500E+00	45.77	41.05	

TABLE D5-8

SPECIMEN NUMBER: 312-294-3						
SPECIMEN ORIENTATION: LONGITUDINAL						
CONSTRAINT: UNSTRESS						
TEST TEMPERATURE: 4.32 MM (1.28 IN) X						
SPECIMEN THICKNESS: 320.6 MPA (46.5 KSI)						
HASTROP STRESS: 320.6 MPA (46.5 KSI)						
FREQUENCY: 200 CPS						
CYCLES TO FAILURE: 85.67 MPA SORTIME (61.61 KSI SORTIME)						
(MIN) 2 CYCLES PRIOR TO FAILURE						
CRACK LENGTH	CYCLES	DELTA(I)/DELTA(II)	DELTA(II)/DELTA(III)	DELTA(III)/DELTA(IV)	DELTA(IV)/DELTA(V)	DELTA(V)/DELTA(VI)
MM	1	MM/CYCLE	IN/CYCLE	PPA SORTIME	KSI SORTIME	
2.72	137	.5754E-03	.2265E-04	16.61	15.12	
4.11	240	.1631E-02	.6421E-04	17.74	17.96	
5.53	320	.2473E-02	.1131E-03	22.17	20.10	
6.62	367	.4487E-02	.1735E-03	24.10	21.94	
7.73	392	.6185E-02	.2435E-03	26.00	23.74	
9.05	415	.1139E-01	.4470E-03	27.96	25.44	
10.21	427	.2320E-01	.9132E-03	32.43	27.64	
12.57	434	.1760E-01	.6930E-03	32.64	29.71	
13.50	436	.3872E-01	.1524E-02	34.11	31.05	
14.93	441	.7677E-01	.3023E-02	35.05	32.82	
16.47	445	.1010E+00	.3470E-02	37.66	34.27	
19.00	467	.1302E+01	.3944E-01	41.78	38.02	
24.09	473					

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TABLE D5-9

SPECIMEN NUMBER: 271-299-1				2124-T851		
ALLOY TYPE: 2024-T861				TRANSVERSE		
SPECIMEN ORIENTATION: 1				UNSTRESSING		
CONSTRAINT: 1				NITROGEN		
ENVIRONMENT: 1				100.0 K		
TEST TEMPERATURE: 1				0.12 MM (1.26E-01 IN)		
SPECIMEN THICKNESS: 1				100.1 MPa (14.5 KSI)		
MAXIMUM STRESS: 1				200 CPM		
R-RATIO: 1				1427 CYCLES		
FREQUENCY: 1				54.05 MPa SQRT (IN) 49.24 KSI SQRT (IN)		
CYCLES TO FAILURE: 1						
KIMAX: 1 CYCLES PRIOR TO FAILURE: 1						
CRACK LENGTH		CYCLES	DELTA(A)/DELTA(H)		DELTA (STRESS INTENSITY)	
MM	IN		MM/CYCLE	IN/CYCLE	MPa SQRT (IN)	KSI SQRT (IN)
2.65	.104	1	.2636E-03	.1.18E-04	14.38	13.19
1.05	.123	1524	.4680E-03	.1839E-04	15.27	13.96
3.37	.133	2221	.9739E-03	.3823E-04	16.36	14.89
3.99	.157	2867	.1564E-02	.1405E-03	17.64	16.19
4.61	.181	3031	.4449E-02	.1750E-03	18.87	17.13
5.14	.202	3193	.5556E-02	.2187E-03	19.76	17.94
5.59	.225	3231	.6055E-02	.7344E-03	20.74	18.70
6.26	.247	3345	.2432E-01	.1114E-02	21.81	19.47
6.83	.269	3265	.4544E-01	.1790E-02	23.07	21.01
7.79	.307	3346	.4591E-01	.1792E-02	24.03	21.87
8.06	.317	3392	.3679E-01	.1404E-02	24.67	22.34
8.45	.333	3433	.3813E-01	.1500E-02	25.11	22.84
8.81	.348	3412	.9673E-01	.3804E-02	25.87	23.48
9.41	.371	3419	.3393E+00	.1336E-01	27.41	25.12
11.45	.451	3425	.1104E+01	.4773E-01	29.67	26.96
F	12.43	3426	.1435E+01	.5657E-01	31.17	28.37
F	13.97	3427				

TABLE D5-10

SPECIMEN NUMBER: 376-256-2				2124-T851		
ALLOY TYPE: 2024-T861				TRANSVERSE		
SPECIMEN ORIENTATION: 1				UNSTRESSING		
CONSTRAINT: 1				NITROGEN		
ENVIRONMENT: 1				100.0 K		
TEST TEMPERATURE: 1				0.40 MM (1.26E-01 IN)		
SPECIMEN THICKNESS: 1				217.2 MPa (31.5 KSI)		
MAXIMUM STRESS: 1				200 CPM		
R-RATIO: 1				1427 CYCLES		
FREQUENCY: 1				54.05 MPa SQRT (IN) 49.19 KSI SQRT (IN)		
CYCLES TO FAILURE: 1						
KIMAX: 1 CYCLES PRIOR TO FAILURE: 1						
CRACK LENGTH		CYCLES	DELTA(A)/DELTA(H)		DELTA (STRESS INTENSITY)	
MM	IN		MM/CYCLE	IN/CYCLE	MPa SQRT (IN)	KSI SQRT (IN)
7.02	.276	1	.2923E-02	.1110E-03	16.84	15.34
8.30	.327	455	.2334E-02	.9104E-04	17.94	16.13
9.05	.356	775	.4424E-02	.1742E-03	18.79	17.10
9.96	.392	982	.5462E-02	.7151E-03	19.49	17.74
11.47	.442	1075	.7994E-02	.1133E-03	20.89	19.11
F	12.45	1387	.2794E-01	.1103E-02	22.64	21.65
F	14.35	1437	.1183E+00	.4537E-02	23.63	21.41
F	15.49	1447	.1774E+00	.7003E-02	24.46	22.25
F	16.38	1452	.4657E+00	.1813E-01	25.34	23.36
F	17.74	1455	.1524E+01	.6000E-01	26.46	24.36
F	19.30	1456				

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TABLE D5-11

SPECIMEN INFORMATION						
SPECIMEN NUMBER: 114-253-1						
SPECIMEN ORIENTATION: 114-253-1						
CONSTRAINTS: TRANSVERSE						
TEST TEMPERATURE: 104.3 K						
SPECIMEN THICKNESS: 0.14 MM (1.5495 IN)						
MAXIMUM STRESS: 152.4 MPA (22.1 KSI)						
FREQUENCY: 200 CPS						
CYCLES TO FAILURE: 20675 CYCLES						
K(MAX) 3 CYCLES PRIOR TO FAILURE 63.1A MPA SORTIM (57.49 KSI SORTIM)						
SPACK LENGTH MM	IN	CYCLES	DELTA(SI)/DELTA(IN) MM/CYCLE	IN/CYCLE	DELTA(STRESS MPA SORTIM)	INTENSITY KSI SORTIM)
6.95	.274	1	.1437E-03	.5650E-05	11.98	18.47
7.52	.296	3995	.1328E-03	.5227E-05	11.91	18.94
7.98	.314	7391	.2640E-03	.1059E-04	12.29	11.18
8.52	.335	9402	.3009E-03	.1185E-04	12.73	11.49
9.19	.362	11639	.7208E-03	.1263E-04	13.19	12.00
9.89	.386	13535	.5135E-03	.7022E-04	13.75	12.51
10.42	.426	15521	.8493E-03	.3243E-04	14.35	13.26
11.62	.458	18458	.7871E-03	.3099E-04	14.77	13.44
12.13	.478	17105	.1245E-02	.4972E-04	15.15	13.79
12.83	.505	17669	.1358E-02	.5344E-04	15.63	14.23
13.71	.540	18315	.1543E-02	.6077E-04	16.13	14.84
14.51	.572	18846	.2943E-02	.1159E-03	16.63	15.14
15.45	.608	19157	.4058E-02	.1913E-03	17.37	15.91
17.17	.676	19512	.4018E-02	.1896E-03	18.20	16.63
18.01	.701	19851	.8243E-02	.3245E-03	19.04	17.33
20.12	.792	20012	.1084E-01	.4267E-03	19.81	18.53
21.89	.862	20174	.1893E-01	.7442E-03	20.61	19.75
21.76	.820	20253	.1571E-01	.6949E-03	21.44	19.51
25.40	1.000	20387	.1945E-01	.7658E-03	22.27	21.37
26.96	1.061	20466	.3334E-01	.1312E-02	23.01	23.34
28.67	1.129	20510	.4556E-01	.1794E-02	23.65	21.62
29.77	1.172	20542	.7357E-01	.9279E-03	24.24	22.36
F 31.37	1.235	20613	.6353E-01	.7533E-02	24.71	22.41
F 32.03	1.260	20620	.1779E+00	.7030E-02	25.06	22.41
F 32.89	1.295	20625	.7627E-01	.7030E-02	25.34	21.06
F 33.27	1.310	20633	.1779E+00	.7030E-02	25.41	21.31
F 34.16	1.345	20635	.2332E+00	.8000E-02	26.02	23.68
F 34.18	1.385	20640	.1778E+00	.7000E-02	26.43	24.25
F 36.07	1.420	20645	.1524E+00	.4000E-02	26.74	24.37
F 36.83	1.450	20653	.2540E+00	.1000E-01	27.21	24.76
F 38.13	1.500	20654	.1691E+00	.8647E-02	27.69	24.20
F 39.12	1.540	20661	.3911E+00	.1500E-01	28.15	25.61
F 40.25	1.585	20664	.2563E+00	.1000E-01	28.49	24.93
F 40.77	1.614	20666	.7623E+00	.3007E-01	28.76	26.17
F 41.53	1.635	20667	.8843E+00	.1500E-01	29.11	26.49
F 42.42	1.670	20669	.1143E+01	.4593E-01	29.57	25.88
F 43.78	1.715	20671	.1143E+01	.4593E-01	30.01	27.31
F 44.70	1.740	20671	.1797E+01	.5593E-01	30.56	27.41
F 46.10	1.819	20671	.1779E+01	.7030E-01	31.21	24.41
F 47.04	1.845	20672				

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SPECIMEN NUMBER: 311-253-3
 ALLOY TYPE: 2124-T831
 SPECIMEN CONCENTRATION: LONGITUDINAL
 TEST: 3000 PSI
 SPECIMEN TYPE: 6.48 MM (1/8 IN) DIA
 HARTUP: 144.01 MPA (20.8 KSI)
 FREQUENCY: 200 CPS
 CYCLES PRIOR TO FAILURE: 48.78 MPA (7.0 KSI)
 CYCLES TO FAILURE: 37.11 KSI

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TABLE D5-13

SPECIMEN NUMBER: 112-250-1
ALLOY TYPE: 2124-T851
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTRESSING
CUTTING METHOD: ARGON
TEST TEMPERATURE: 302.6 K
SPECIMEN THICKNESS: 5.53 MM (0.217 IN)
MAXIMUM STRESS: 217.2 MPa (31.5 KSI)
FREQUENCY: 200 CYCLES
CYCLES TO FAILURE: 327
MINIMUM: 3 CYCLES PRIOR TO FAILURE
94.07 MPa (SORT(M)) 85.61 KSI (SORT(M))

CRACK LENGTH IN	IN	CYCLE	DELTA S (1)/DELTA S (2) IN/CYCLE	IN/CYCLE	DELTA STRESS INTENSITY MPa SORT(M)	KSI SORT(M)
10.95	0.198					
6.47	0.116	1482	0.9947E-03	0.7916E-04	25.07	27.97
6.47	0.255	1861	0.2751E-02	0.1943E-03	28.04	25.70
7.11	0.280	2131	0.2339E-02	0.9210E-04	30.18	27.46
7.93	0.312	2324	0.4791E-01	0.1494E-03	31.76	29.91
8.92	0.351	2519	0.4434E-02	0.1405E-03	33.44	33.41
9.51	0.375	2615	0.5237E-02	0.2479E-03	39.21	32.14
10.11	0.398	2845	0.7121E-02	0.2806E-03	46.32	31.35
11.46	0.451	2812	0.1149E-01	0.4504E-03	34.09	34.47
12.01	0.509	2909	0.1177E-01	0.4607E-03	45.56	35.31
13.28	0.527	2924	0.2224E-01	0.4775E-03	42.14	39.30
14.45	0.569	2979	0.2541E-01	0.4412E-03	43.37	39.47
F	17.40	3031	0.5467E-01	0.7151E-02	46.88	42.31
F	19.19	3171	0.4444E-01	0.1741E-02	44.92	46.47
F	20.70	3103	0.5319E-01	0.2009E-02	52.22	47.02
F	22.35	3131	0.5503E-01	0.2167E-02	44.40	44.47
F	24.35	3163	0.6773E-01	0.2667E-02	46.77	51.17
F	25.53	3183	0.5715E-01	0.2251E-02	44.80	51.51
F	27.31	3211	0.4403E-01	0.2501E-02	61.63	51.17
F	24.23	3219	0.1515E-02	0.4107E-02	62.64	52.52
F	31.44	3229	0.1651E-01	0.4403E-02	64.87	54.71
F	32.16	3239	0.1774E-01	0.7000E-02	66.81	63.50
F	34.47	3244	0.2159E-02	0.4501E-02	58.97	62.71
F	31.07	3257	0.1434E-01	0.7222E-02	71.14	64.74
F	30.11	3261	0.5102E-01	0.2300E-01	74.24	64.87
F	39.51	3261	0.4449E-01	0.2753E-01	75.21	64.44
F	41.15	3245	0.4254E-01	0.3253E-01	74.04	71.14
F	43.14	3267	0.1114E-01	0.4107E-01	70.04	71.95
F	49.13	3267	0.2476E-01	0.4953E-01	73.01	75.36
F	51.19	3271	0.3144E-01	0.2301E-01	47.61	71.73

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TABLE D5-14

<p>SPECIMEN NUMBER: 317-259-1 ALLOY TYPE: 2124-T851 SPECIMEN ORIENTATION: LONGITUDINAL CONSTRAINT: UNSTIFFENED TEST TEMPERATURE: 299.8 K SPECIMEN THICKNESS: 6.33 MM (0.249 IN) MAXIMUM STRESS: 393.2 MPA (56.6 KSI) FREQUENCY: 200 CPM K(MAX): 5 CYCLES PRIOR TO FAILURE: 80.78 MPA SORT(MIN) 73.52 KSI SORT(MIN)</p>						
CRACK LENGTH MM IN	CYCLES 1	DELTA(A)/DELTA(B) MM/CYCLE IN/CYCLE	DELTA(1) STRESS MPA SORT(MIN)	INTENSITY KSI SORT(MIN)		
2.92	119	0.146E-01	0.411E-03	33.66	33.63	
3.43	135	0.567E-02	0.221E-03	36.36	33.39	
3.99	167	0.495E-02	0.195E-03	39.32	35.79	
4.46	175	0.144E-01	0.608E-03	41.97	38.19	
4.65	183	0.854E-02	0.334E-03	43.56	39.64	
5.12	202	0.190E-01	0.741E-03	45.12	41.26	
5.49	216	0.214E-01	0.844E-03	47.02	42.79	
5.97	235	0.301E-01	0.110E-02	48.87	44.47	
6.31	249	0.746E-01	0.138E-02	50.82	46.04	
7.37	290	0.404E-01	0.159E-02	53.63	48.63	
8.08	318	0.476E-01	0.187E-02	56.80	51.69	
8.78	346	0.694E-01	0.273E-02	59.35	54.01	
9.40	370	0.620E-01	0.246E-02	61.65	56.11	
10.37	400	0.138E-00	0.549E-02	64.33	58.54	
10.74	423	0.917E-01	0.761E-02	66.49	60.51	
11.45	451	0.141E-00	0.957E-02	68.19	62.05	
12.39	488	0.180E-00	0.741E-02	70.71	64.35	
13.24	521	0.171E-00	0.675E-02	73.38	66.78	
13.99	551	0.149E-00	0.598E-02	75.69	68.88	

TABLE D5-15

<p>SPECIMEN NUMBER: 214-253-2 ALLOY TYPE: 2124-T851 SPECIMEN ORIENTATION: TRANSVERSE CONSTRAINT: UNSTIFFENED TEST TEMPERATURE: 300.0 K SPECIMEN THICKNESS: 140.0 MPA (20.3 KSI) MAXIMUM STRESS: 140.0 MPA (20.3 KSI) FREQUENCY: 200 CPM K(MAX): 40 CYCLES PRIOR TO FAILURE: 41.51 MPA SORT(MIN) 37.74 KSI SORT(MIN)</p>						
CRACK LENGTH MM IN	CYCLES 1	DELTA(A)/DELTA(B) MM/CYCLE IN/CYCLE	DELTA(1) STRESS MPA SORT(MIN)	INTENSITY KSI SORT(MIN)		
3.58	141	0.183E-03	0.608E-05	14.42	13.13	
3.91	156	0.181E-03	0.715E-05	15.24	13.87	
4.44	175	0.767E-03	0.278E-04	16.65	15.15	
5.52	217	0.754E-03	0.297E-04	18.26	16.62	
6.46	254	0.792E-03	0.312E-04	19.51	17.76	
7.21	284	0.145E-02	0.572E-04	20.60	18.75	
8.02	316	0.114E-02	0.452E-04	21.78	19.82	
8.90	354	0.175E-02	0.688E-04	23.10	21.03	
10.14	399	0.267E-02	0.105E-03	25.21	22.94	
12.57	495	0.480E-02	0.157E-03	27.16	24.71	
13.73	540	0.615E-02	0.242E-03	28.34	25.79	
14.87	585	0.551E-02	0.217E-03	29.13	26.78	
15.72	619	0.806E-02	0.315E-03	30.27	27.55	
16.88	681	0.128E-01	0.475E-03	31.17	28.37	
17.62	694	0.828E-02	0.322E-03	31.98	28.88	
18.58	728	0.246E-01	0.969E-03	32.67	29.91	
19.63	773	0.376E-01	0.148E-02	33.83	30.70	
20.69	813	0.232E-01	0.915E-03	34.72	31.68	
21.61	854	0.282E-01	0.113E-02	35.43	32.78	
23.48	924	0.638E-01	0.248E-02	38.87	34.65	
26.88	1058					

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TABLE D5-18

SPECIMEN NUMBER: 111-253-3
SPEAKER TYPE: 1000 Hz
SPEAKER POSITION: 1000 Hz
SPEAKER DIRECTION: 1000 Hz
TEST TEMPERATURE: 300 K
SPECIMEN THICKNESS: 1000 Hz
PARTIAL STRESS: 1000 Hz
FREQUENCY: 1000 Hz
CYCLES TO FAILURE: 1000 Hz
K(MAN): 35 CYCLES PRIOR TO FAILURE: 1000 Hz
82.97 MPA SORTING: 1000 Hz
79.91 KSI SORTING: 1000 Hz

CRACK LENGTH IN	CYCLES	DELTA K(I)/DELTA K(II) IN/CYCLE	DELTA STRESS MPA SORTING	INTENSITY KSI SORTING
10.35	5793	.3304E-03	13.44	12.23
11.96	6425	.6102E-03	14.22	12.94
12.64	8474	.5359E-03	14.65	13.33
13.43	9416	.8237E-03	15.09	13.73
14.28	10635	.1234E-02	15.48	14.09
14.84	10644	.9645E-03	15.81	14.39
15.43	11244	.8707E-03	16.11	14.66
15.95	11931	.1040E-02	16.43	14.95
16.67	12923	.1864E-02	16.78	15.27
17.38	13339	.9330E-03	17.13	15.59
18.07	13912	.1532E-02	17.54	15.96
18.94	14918	.1191E-02	18.05	16.43
20.17	15995	.1500E-02	19.54	17.00
21.41	16610	.2041E-02	19.34	17.61
23.07	16975	.3077E-02	19.94	18.15
24.14	17360	.3101E-02	20.45	18.61
25.18	17744	.3717E-02	21.97	19.05
26.55	18249	.3275E-02	21.94	19.64
28.14	18597	.3369E-02	22.16	20.16
29.26	18938	.4080E-02	22.78	20.56
30.74	19041	.5634E-02	23.77	21.13
31.76	19316	.9199E-02	23.67	21.54
32.90	19426	.1013E-01	24.14	21.97
34.09	19613	.7560E-02	24.47	22.45
35.58	19763	.7044E-02	25.19	22.92
36.84	19877	.9636E-02	25.62	23.31
37.73	19987	.1183E-01	26.12	23.77
38.15	20175	.1248E-01	26.70	24.30
40.64	20703	.1574E-01	27.30	24.94
42.17	20297	.1274E-01	27.94	25.34
43.17	20344	.1637E-01	28.82	25.75
44.47	20449	.1854E-01	29.62	26.23
46.03	20499	.2744E-01	29.62	26.77
47.45	20561	.1584E-01	30.43	27.25
49.48	20611	.2394E-01	30.97	27.69
49.94	20671	.2524E-01	31.54	28.19
51.39	20713	.3904E-01	32.24	28.74
52.46	20769	.3224E-01	32.94	29.34
54.67	20814	.2627E-01	33.74	29.97
56.25	20873	.6147E-01	34.50	30.72
58.41	20914	.3649E-01	35.14	31.49
61.29	20952	.4557E-01	35.14	32.28
62.25	21024	.6191E-01	35.14	33.12
64.97	21034	.6949E-01	35.14	34.06
66.92	21034	.1354E-01	35.14	34.95
69.25	21054	.2109E-01	35.14	35.52
71.26	21054	.1902E-01	40.15	36.56
72.58	21054	.4496E-01	41.37	37.31
74.54	21070			

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TABLE D5-19

SPECIMEN NUMBER: 217-256-1				217-256-1		
SLOT TYPE: LONGITUDINAL				LONGITUDINAL		
SPECIMEN ORIENTATION: UNSTIFFENED				UNSTIFFENED		
CONSTRAINT: NONE				NONE		
TEST TEMPERATURE: 30.0 °C				30.0 °C		
SPECIMEN THICKNESS: 6.34 MM				6.34 MM		
MAXIMUM STRESS: 217.2 MPa				217.2 MPa		
FREQUENCY: 200 CPM				200 CPM		
CYCLES TO FAILURE: 6974				6974		
MINMAX: 17 CYCLES PRIOR TO FAILURE				74.26 MPa SQRT(IN) 72.37 KSI SQRT(IN)		
CRACK LENGTH MM	CRACK LENGTH IN	CYCLES	DELTA(A)/DELTA(B) MM/CYCLE	DELTA(A)/DELTA(B) IN/CYCLE	DELTA(Stress Intensity) MPa SQRT(IN)	DELTA(Stress Intensity) KSI SQRT(IN)
6.84	.269					
7.17	.272	2421	.4591E-03	.1834E-04	16.7	15.20
9.42	.371	3734	.1145E-02	.4240E-04	18.09	16.47
11.71	.452	4754	.1973E-01	.7786E-04	19.26	17.62
11.44	.440	4625	.2761E-07	.1044E-03	20.33	18.50
12.70	.461	4834	.1440E-02	.5746E-04	20.79	18.92
13.72	.524	4954	.1074E-01	.4247E-03	21.63	19.68
15.07	.591	5231	.6345E-02	.2444E-03	23.06	21.49
16.43	.647	5479	.5457E-02	.2149E-03	24.32	22.14
17.54	.690	5553	.4973E-02	.1933E-03	25.24	23.01
18.42	.725	5661	.1294E-01	.5094E-03	26.04	23.70
19.21	.746	5732	.1113E-01	.4381E-03	26.67	24.27
20.13	.793	5823	.1050E-01	.4153E-03	27.29	24.94
21.89	.862	5952	.1333E-01	.5245E-03	28.25	25.71
24.28	.953	6093	.1837E-01	.7304E-03	29.66	26.99
24.37	.999	6129	.2400E-01	.9449E-03	30.83	28.36
29.09	1.145	6241	.3174E-01	.1230E-02	32.44	29.52
29.45	1.167	6267	.2924E-01	.1153E-02	33.80	31.76
30.78	1.212	6287	.5477E-01	.2235E-02	34.34	31.25
38.82	1.528	6357	.1119E+00	.4522E-02	37.17	33.43

TABLE D5-20

SPECIMEN NUMBER: 217-256-1				217-256-1		
SLOT TYPE: LONGITUDINAL				LONGITUDINAL		
SPECIMEN ORIENTATION: UNSTIFFENED				UNSTIFFENED		
CONSTRAINT: NONE				NONE		
TEST TEMPERATURE: 30.0 °C				30.0 °C		
SPECIMEN THICKNESS: 6.34 MM				6.34 MM		
MAXIMUM STRESS: 217.2 MPa				217.2 MPa		
FREQUENCY: 200 CPM				200 CPM		
CYCLES TO FAILURE: 7312				7312		
MINMAX: 2 CYCLES PRIOR TO FAILURE				74.43 MPa SQRT(IN) 71.37 KSI SQRT(IN)		
CRACK LENGTH MM	CRACK LENGTH IN	CYCLES	DELTA(A)/DELTA(B) MM/CYCLE	DELTA(A)/DELTA(B) IN/CYCLE	DELTA(Stress Intensity) MPa SQRT(IN)	DELTA(Stress Intensity) KSI SQRT(IN)
2.35	.092					
2.83	.111	211	.2247E-02	.8343E-04	17.27	15.72
3.52	.136	403	.3636E-02	.1432E-03	19.13	17.41
4.21	.166	452	.4594E-02	.1793E-03	21.11	19.21
4.82	.190	594	.1691E-01	.6633E-03	22.42	20.77
5.42	.213	604	.3604E-01	.1102E-02	24.31	22.12
6.17	.243	639	.7427E-01	.2565E-03	25.87	23.94
6.81	.268	660	.3433E-01	.1147E-02	27.38	24.92
7.24	.287	661	.2742E-01	.1030E-02	28.94	26.37
7.81	.308	685	.1047E+00	.4200E-02	29.94	26.89
8.37	.330	697	.1121E+00	.4410E-02	31.81	27.85
9.11	.359	695	.1464E+00	.5740E-02	31.81	29.45
9.76	.384	700	.1304E+00	.5150E-02	33.06	30.39
11.22	.432	735	.9119E+01	.3743E-02	34.03	31.47
F	12.83	787	.1305E+01	.5137E-01	36.54	33.79
F	13.21	724	.3711E+00	.1537E-01	38.42	34.62

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SPECIMEN NUMBER:
ALLOY TYPE:
SPECIMEN ORIENTATION:
CONSTRAINTS:
ENVIRONMENT:
TEST TEMPERATURE:
SPECIMEN THICKNESS:
MAXIMUM STRESS:
          STRAIN:
          FREQUENCY:
CYCLES TO FAILURE:
CYCLES PRIOR TO FAILURE:

```

175-253-
2126-705
TRANSVERSE
UNSTIFFENED
ADON
320.4
6.38 MM (1.251 IN)
140.0 MPA (20.2 KSI)
280 C
12119 CYCLES
1.52.54 KSI (20.2 KSI)

DRACH LENGTH IN	IN	CYCLES	DELTA(S)/DELTA(M) MM/CYCLE	DELTA(S)/DELTA(M) IN/CYCLE	DELTA(STRESS INTENSITY) MPa SQRT(IN)	KSI SQRT(IN)
10.00	.005	1	.001E-03	.1609E-04	12.92	11.76
11.20	.044	2375	.5675E-03	.7234E-04	13.49	12.28
12.70	.000	3993	.AC77E-03	.3149E-04	13.91	12.66
12.74	.501	4659	.9522E-03	.3513E-04	14.20	12.92
13.23	.021	5203	.5484E-03	.2127E-04	14.42	13.12
13.53	.033	5763	.9762E-03	.3043E-04	14.82	13.40
14.69	.074	6940	.1425E-02	.5011E-04	15.33	13.95
15.47	.009	7496	.1315E-02	.5179E-04	15.72	14.31
16.20	.032	8055	.1676E-02	.6400E-04	16.11	14.66
17.03	.669	8730	.1047E-02	.6485E-04	16.44	14.96
17.96	.691	8872	.2049E-02	.1003E-03	16.76	15.26
18.31	.721	9164	.2211E-02	.1070E-03	17.06	15.53
18.81	.741	9390	.2610E-02	.1031E-03	17.37	15.81
19.62	.772	9696	.3073E-02	.1446E-03	17.94	16.33
21.25	.837	10144	.4650E-02	.1034E-03	18.66	16.90
22.77	.896	10460	.6275E-02	.2674E-03	19.29	17.56
24.12	.950	10672	.7991E-02	.3146E-03	19.90	18.11
25.00	1.000	10857	.9305E-02	.3603E-03	20.50	18.66
26.94	1.061	11001	.8370E-02	.3299E-03	21.20	19.30
28.97	1.140	11243	.1140E-01	.4522E-03	21.89	19.92
30.30	1.193	11359	.1125E-01	.4420E-03	22.49	20.47
31.94	1.250	11505	.1026E-01	.7191E-03	23.18	21.09
33.71	1.327	11602	.1040E-01	.7274E-03	23.83	21.69
35.20	1.388	11606	.1797E-01	.8919E-03	24.36	22.17
36.41	1.433	11751	.6439E-01	.1020E-02	25.06	22
38.06	1.530	11804	.2763E-01	.1800E-02	25.90	23.00
40.70	1.602	11871	.3205E-01	.1295E-02	26.62	24.23
42.61	1.676	11929	.4127E-01	.1625E-02	27.21	24.76
43.77	1.723	11957	.6512E-01	.2566E-02	28.01	25.49
46.75	1.841	12003	.7192E-01	.2032E-02	28.12	26.50
49.50	1.949	12041	.6223E-01	.2450E-02	29.90	27.21
50.74	1.970	12061	.0740E-01	.3460E-02	30.40	27.66
52.06	2.050	12076	.1822E-00	.5992E-02	31.05	28.26
54.04	2.127	12085	.1249E-00	.6917E-02	31.66	28.82
55.16	2.172	12098	.1137E+00	.6675E-02	32.03	29.14
55.94	2.189	12104				

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TABLE D5-22

SPECIMEN NUMBERS				373-256-1			
ALLOY TYPE				2124-T851			
SPECIMEN ORIENTATION				TRANVERSE			
CONSTRAINTS				UNSTIFFENED			
ENVIRONMENT				ARGON			
TEST TEMPERATURE				103.2 K			
SPECIMEN THICKNESS				6.43 MM (0.252 IN)			
MAXIMUM STRESS				217.2 MPa (31.5 KSI)			
R-RATIO				0			
FREQUENCY				200 CPA			
CYCLES TO FAILURE				2627 CYCLES			
K(MAX) 3 CYCLES PRIOR TO FAILURE				64.29 MPa SORT(M) (9.81 KSI SORT(M))			

CRACK LENGTH	MM	IN	CYCLES	DELTA (A1)/DELTA (A2)	MM/CYCLE	IN/CYCLE	DELTA (STRESS INTENSITY)	MPa SORT(M)	KSI SORT(M)
6.96	.274		1	.1121E-02	.4410E-04		17.17	15.62	
8.48	.350		1731	.3437E-02	.1351E-03		18.73	17.04	
9.94	.391		2033	.4091E-02	.1671E-03		20.42	18.98	
12.41	.488		2284	.6353E-02	.2502E-03		22.03	20.15	
13.95	.533		2464	.4449E-01	.1750E-02		23.59	21.47	
16.13	.635		2522	.7554E-01	.1471E-02		25.54	23.25	
18.51	.729		2589	.7893E-01	.1392E-02		27.13	24.69	
20.39	.803		2613	.3135E+01	.1234E-01		28.70	26.12	
22.90	.902		2621	.1292E+01	.5088E-01		30.47	28.19	
26.78	1.054		2624						

TABLE D5-23

SPECIMEN NUMBERS				374-253-1			
ALLOY TYPE				2124-T851			
SPECIMEN ORIENTATION				TRANVERSE			
CONSTRAINTS				UNSTIFFENED			
ENVIRONMENT				ARGON			
TEST TEMPERATURE				248.0 K			
SPECIMEN THICKNESS				6.16 MM (0.243 IN)			
MAXIMUM STRESS				171.1 MPa (24.8 KSI)			
R-RATIO				0			
FREQUENCY				200 CPA			
CYCLES TO FAILURE				265 CYCLES			
K(MAX) 15 CYCLES PRIOR TO FAILURE				45.81 MPa SORT(M) (41.49 KSI SORT(M))			

CRACK LENGTH	MM	IN	CYCLES	DELTA (A1)/DELTA (A2)	MM/CYCLE	IN/CYCLE	DELTA (STRESS INTENSITY)	MPa SORT(M)	KSI SORT(M)
2.27	.089		1	.1712E-02	.1462E-04		14.55	13.17	
2.75	.108		131	.7681E-02	.3024E-03		14.01	12.85	
3.23	.127		193	.1554E-01	.6122E-03		19.61	17.84	
3.80	.150		231	.4197E-01	.1614E-02		20.00	18.13	
4.25	.167		241	.4956E-01	.2364E-02		22.24	20.24	
4.79	.190		251						

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TABLE D5-24

SPECIMEN NUMBER: 2L2-2F3-6
ALLOY TYPE: 2124-T851
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTRESSFED
ENVIRONMENT: NET AIR
TEST TEMPERATURE: 291.7 K
SPECIMEN THICKNESS: 6.43 MM (1.259 IN)
MAXIMUM STRESS: 146.1 MPA (20.9 KSI)
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 12035 CYCLES
K(MAX): 1.93 CYCLES PRIOR TO FAILURE: 39.69 MPA SORTING: 16.12 KSI SORTING

CRACK LENGTH IN	CYCLES	DELTA(A)/DELTA(I) MM/CYCLE	DELTA(A)/DELTA(I) IN/CYCLE	DELTA STRESS INTENSITY MPA SORTING	DELTA STRESS INTENSITY KSI SORTING
3.67	144				
4.11	174	.3633E-03	.1438E-04	15.33	13.95
5.15	3237	.5627E-03	.2216E-04	16.70	15.19
5.74	4140	.6674E-03	.2627E-04	17.92	16.30
6.41	4919	.8641E-03	.3432E-04	18.93	17.23
6.98	5684	.7472E-03	.2926E-04	19.44	18.09
7.58	6373	.8677E-03	.3416E-04	20.73	19.87
8.28	6944	.1190E-02	.4687E-04	21.64	19.70
9.46	7735	.1066E-02	.4196E-04	22.51	21.48
9.69	8053	.1135E-02	.4255E-04	23.14	21.26
10.24	8344	.1196E-02	.4791E-04	24.21	22.05
11.10	8814	.1414E-02	.5557E-04	25.15	22.89
11.74	9174	.1777E-02	.6974E-04	26.32	23.84
12.46	9455	.2279E-02	.8094E-03	26.90	24.39
13.33	9735	.3116E-02	.1227E-03	27.69	25.70
13.91	9944	.2326E-02	.9157E-04	28.47	25.91
14.44	10144	.2544E-02	.1043E-03	29.04	26.44
15.14	10357	.3454E-02	.1354E-03	29.64	27.98
15.64	10535	.4305E-02	.1696E-03	30.27	27.55
16.42	10664	.6564E-02	.1794E-03	30.94	28.17
16.35	10836	.3175E-02	.1250E-03	31.54	28.74
17.42	11021	.4675E-02	.1841E-03	32.26	29.36
18.34	11142	.6692E-02	.1847E-03	32.96	29.94
19.73	11362	.6104E-02	.2405E-03	33.44	30.80
21.12	11572	.6634E-02	.2612E-03	34.29	31.93
22.10	11727	.7634E-02	.3006E-03	36.21	32.87
23.41	11842	.9632E-02	.3791E-03	37.21	33.88

TABLE D5-25

SPECIMEN NUMBER: 3L3-256-1
ALLOY TYPE: 2124-T851
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTRESSFED
ENVIRONMENT: NET AIR
TEST TEMPERATURE: 297.6 K
SPECIMEN THICKNESS: 6.30 MM (1.248 IN)
MAXIMUM STRESS: 217.2 MPA (31.5 KSI)
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 2494 CYCLES
K(MAX): .855 CYCLES PRIOR TO FAILURE: 34.53 MPA SORTING: 31.42 KSI SORTING

CRACK LENGTH IN	CYCLES	DELTA(A)/DELTA(I) MM/CYCLE	DELTA(A)/DELTA(I) IN/CYCLE	DELTA STRESS INTENSITY MPA SORTING	DELTA STRESS INTENSITY KSI SORTING
3.64	144				
4.44	175	.1422E-02	.5598E-04	23.23	21.14
5.20	892	.2275E-02	.8954E-04	25.37	23.08
5.56	1103	.1704E-02	.6730E-04	26.88	24.39
6.21	1245	.3702E-02	.1458E-03	28.04	25.51
7.19	1528	.3586E-02	.1569E-03	29.93	27.24
8.02	1639	.7305E-02	.2876E-03	31.99	29.02

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TABLE D5-26

SPECIMEN NUMBER: 113-250-2
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
ENVIRONMENT: SEA AIR
TEST TEMPERATURE: 29.0 °C
SPECIMEN THICKNESS: 6.32 MM (0.249 IN)
MAXIMUM STRESS: 332.5 MPA (48.0 KSI)
R-RATIO: 0.0
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 618
KINAK: 6 CYCLES PRIOR TO FAILURE: 01.20 MPA SORT(MI) 73.09 KSI SORT(INI)

CRACK LENGTH MM	IN	CYCLES	DELTA(A)/DELTA(B) MM/CYCLE	IN/CYCLE	DELTA STRESS MPA SORT(MI)	INTENSITY KSI SORT(INI)
2.52	.099	1	.1377E-02	.5421E-04	29.02	27.14
3.02	.119	369	.3164E-02	.1249E-03	32.92	29.95
3.73	.147	591	.5299E-02	.2060E-03	36.32	33.05
4.49	.177	736	.6942E-02	.3363E-03	39.96	36.37
5.45	.215	849	.1010E-01	.4000E-03	42.93	39.07
6.01	.237	904	.1037E-01	.7233E-03	44.97	40.92
6.80	.258	934	.2727E-01	.1074E-02	46.05	42.64
7.38	.279	953	.2362E-01	.9306E-03	48.97	44.92
7.79	.307	983	.2558E-01	.1084E-02	51.10	46.51
8.43	.332	1000	.4004E-01	.1600E-02	53.05	48.27
9.04	.356	1023	.2460E-01	.9700E-03	55.29	50.32
9.93	.391	1059	.4100E-01	.1646E-02	57.31	52.15
10.43	.411	1071	.4639E-01	.1020E-02	59.12	53.00
11.22	.442	1080	.3849E-01	.1523E-02	60.98	55.50
11.80	.464	1103	.4299E-01	.1691E-02	62.39	56.77
12.27	.483	1114	.3009E-01	.1531E-02	64.21	58.44
13.20	.520	1130	.0657E-01	.3400E-02	66.05	60.11
13.72	.540	1144	.9842E-01	.3860E-02	67.02	61.72
14.63	.576	1154	.1092E+00	.4300E-02	69.57	63.31
15.17	.597	1159	.9003E-01	.3546E-02	71.10	66.70
15.90	.629	1160	.1031E+00	.7200E-02	73.39	68.79
17.00	.672	1174	.2249E+00	.8040E-02	75.90	69.07
18.20	.717	1174				

TABLE D5-27

SPECIMEN NUMBER: 375-293-3
ALLOY TYPE: 2124-T851
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINT: UNSTIFFENED
ENVIRONMENT: SEA AIR
TEST TEMPERATURE: 29.0 °C
SPECIMEN THICKNESS: 6.53 MM (0.257 IN)
MAXIMUM STRESS: 143.0 MPA (20.7 KSI)
R-RATIO: 0.0
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 618
KINAK: 618 CYCLES PRIOR TO FAILURE: 20.05 MPA SORT(MI) 26.44 KSI SORT(INI)

CRACK LENGTH MM	IN	CYCLES	DELTA(A)/DELTA(B) MM/CYCLE	IN/CYCLE	DELTA STRESS MPA SORT(MI)	INTENSITY KSI SORT(INI)
3.04	.121	1	.6321E-03	.7400E-04	15.37	13.99
4.46	.183	1297	.7203E-03	.2830E-04	16.71	15.22
5.40	.213	2336	.9250E-03	.7640E-04	17.99	16.37
6.22	.245	3221	.1377E-02	.5410E-04	19.14	17.62
6.94	.273	3743	.1347E-02	.5304E-04	20.17	18.32
7.60	.299	4234	.2.04E-02	.8234E-04	21.24	19.33
8.47	.337	4690	.1947E-02	.7665E-04	22.19	20.19
9.67	.357	4454	.3147E-02	.1236E-03	22.82	21.77
10.58	.417	5114	.2504E-02	.1017E-03	23.49	21.30
11.10	.401	6349	.3621E-02	.1425E-03	24.27	22.25
11.83	.426	5529	.4264E-02	.1602E-03	24.97	22.72
11.45	.441	5601	.5330E-02	.2131E-03	25.74	23.42
12.21	.481	5024	.6062E-02	.2644E-03	26.50	24.12
12.85	.506	5917	.7855E-02	.3092E-03	27.23	24.70
13.57	.534	6809				

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TABLE D5-28

SPECIMEN NUMBER: 311-283-2					
SPECIMEN ORIENTATION: 311-283-2					
TEST TEMPERATURE: 311-283-2					
SPECIMEN THICKNESS: 311-283-2					
MAXIMUM STRESS: 311-283-2					
CYCLES TO FAILURE: 311-283-2					
N(MAN) 4 CYCLES PRIOR TO FAILURE: 311-283-2					
41.48 MPA SORT(M) (37.75 KSI SORT(M))					
CRACK LENGTH	CYCLES	DELTA(I)/DELTA(II)	DELTA(III)/DELTA(IV)	DELTA(IV) STRESS INTENSITY	DELTA(IV) STRESS INTENSITY
2.33	1	.0402E-02	.3331E-03	32.90	24.65
3.06	97	.0007E-01	.3061E-02	37.13	33.79
3.96	96				

TABLE D5-29

SPECIMEN NUMBER: 311-283-2					
SPECIMEN ORIENTATION: 311-283-2					
TEST TEMPERATURE: 311-283-2					
SPECIMEN THICKNESS: 311-283-2					
MAXIMUM STRESS: 311-283-2					
CYCLES TO FAILURE: 311-283-2					
N(MAN) 6 CYCLES PRIOR TO FAILURE: 311-283-2					
79.28 MPA SORT(M) (72.15 KSI SORT(M))					
CRACK LENGTH	CYCLES	DELTA(I)/DELTA(II)	DELTA(III)/DELTA(IV)	DELTA(IV) STRESS INTENSITY	DELTA(IV) STRESS INTENSITY
8.00	1	.2301E-03	.0195E-05	11.01	10.75
9.03	4925	.4137E-03	.1625E-04	12.45	11.33
9.89	7080	.4394E-03	.1715E-04	12.96	11.79
10.58	8589	.3400E-03	.1373E-04	13.34	12.14
11.18	10002	.6535E-03	.2573E-04	11.71	12.47
11.77	11110	.5995E-03	.2301E-04	14.21	12.93
12.70	12796	.0207E-03	.3263E-04	14.91	13.57
14.21	14520	.7907E-03	.3113E-04	19.66	14.25
15.80	16147	.1033E-02	.4005E-04	16.35	14.88
16.90	17434	.1507E-02	.6247E-04	17.05	15.92
18.25	18318	.1111E-02	.4374E-04	17.71	16.12
19.48	19417	.1725E-02	.6790E-04	18.29	16.64
20.62	20086	.1935E-02	.7617E-04	18.89	17.19
22.07	20810	.1539E-02	.6059E-04	19.51	17.75
23.30	21641	.2904E-02	.1175E-03	20.30	18.27
24.57	22064	.2756E-02	.1085E-03	20.62	18.76
25.71	22487	.3356E-02	.1321E-03	21.29	19.19
26.72	22781	.1771E-02	.1405E-03	21.54	19.70
28.12	23205	.0642E-02	.2221E-03	22.32	20.31
29.90	23485	.3798E-02	.1495E-03	22.90	20.44
31.09	23800	.0613E-02	.2210E-03	23.36	21.26
32.14	23946	.0435E-02	.2140E-03	23.99	21.73
33.63	24254	.0530E-02	.3754E-03	24.51	22.31
35.26	24429				
36.47	24634	.0677E-02	.2675E-03	25.14	22.83
37.91	24776	.0462E-02	.3331E-03	25.62	23.31
39.23	24910	.0241E-02	.3166E-03	26.17	23.82
40.55	25093	.0527E-02	.3397E-03	26.69	24.29
41.55	25224	.0711E-02	.3115E-03	27.15	24.71
42.40	25344	.1123E-01	.4421E-03	27.47	25.14
44.44	25440	.1444E-01	.5724E-03	27.79	25.74
46.10	25594	.1175E-01	.6230E-03	28.92	26.32
47.10	25694	.1493E-01	.5067E-03	29.35	26.71
48.10	25754	.2202E-01	.0120E-03	29.34	27.24
50.63	25837	.1064E-01	.7317E-03	30.64	27.90
51.73	25888	.2201E-01	.0667E-03	31.20	28.19
53.15	25968	.2101E-01	.0273E-03	31.74	28.49
55.29	26022	.3195E-01	.1254E-02	32.44	29.50
57.87	26092	.1512E-01	.1940E-02	33.41	30.41
59.73	26129	.5154E-01	.2079E-02	34.14	31.25
61.50	26172	.0607E-01	.3530E-02	35.54	32.34
65.82	26192	.1167E-01	.4575E-02	36.47	33.56
70.70	26201	.4433E-01	.1745E-01	38.50	35.04

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TABLE D5-30

SPECIMEN NUMBER: ALLOY TYPE: SPECIMEN ORIENTATION: CONSTRAINT: ENVIRONMENT: TEST TEMPERATURE: SPECIMEN THICKNESS: MAXIMUM STRESS: FREQUENCY: CYCLES TO FAILURE: (MIN) 4186 CYCLES PRIOR TO FAILURE				112-250-2 2124-T851 LONGITUDINAL UNSTRESSING 297.8 K 6.53 MM (0.258 IN) 217.2 MPa (31.5 KSI) 200 CPM 13176 CYCLES 33.89 MPa SORTIME 30.84 KSI SORTIME		
CRACK MM	LENGTH IN	CYCLES	DELTA(A)/DELTA(W) MM/CYCLE	IN/CYCLE	DELTA(Stress Intensity) MPa SORTIME	KSI SORTIME
3.29	.138	1	.1818E-03	.7159E-05	11.31	10.38
3.61	.142	1761	.3654E-03	.1440E-04	12.80	10.92
4.19	.163	3733	.4356E-03	.1719E-04	12.85	11.69
4.79	.187	4612	.5915E-03	.2171E-04	13.73	12.98
5.42	.213	8821	.8760E-03	.3449E-04	14.57	13.26
6.03	.237	6914	.9464E-03	.2151E-04	15.30	13.92
6.58	.259	7526	.6490E-03	.2585E-04	16.07	14.44
6.99	.275	8159	.8676E-03	.3416E-04	16.93	15.85
7.73	.304	9888				

TABLE D5-31

SPECIMEN NUMBER: ALLOY TYPE: SPECIMEN ORIENTATION: CONSTRAINT: ENVIRONMENT: TEST TEMPERATURE: SPECIMEN THICKNESS: MAXIMUM STRESS: FREQUENCY: CYCLES TO FAILURE: (MIN) 18 CYCLES PRIOR TO FAILURE				515-250-2 2124-T851 LONGITUDINAL UNSTRESSING 297.8 K 6.30 MM (0.248 IN) 304.9 MPa (44.0 KSI) 200 CPM 2911 CYCLES 73.76 MPa SORTIME 67.13 KSI SORTIME		
CRACK MM	LENGTH IN	CYCLES	DELTA(A)/DELTA(W) MM/CYCLE	IN/CYCLE	DELTA(Stress Intensity) MPa SORTIME	KSI SORTIME
2.28	.090	1	.6883E-03	.2717E-04	18.01	16.39
3.29	.130	1477	.1923E-02	.1544E-03	20.10	18.29
3.69	.144	1567	.3086E-02	.1207E-03	20.78	18.91
3.77	.148	1607	.3596E-02	.1022E-03	21.75	19.79
4.35	.171	1832	.1063E-02	.1206E-03	23.44	21.38
5.12	.202	2782	.1510E-02	.1344E-03	25.24	23.41
5.68	.224	2242	.4146E-02	.1644E-03	26.32	23.95
6.01	.244	2367	.6041E-02	.2737E-03	27.44	24.16
6.91	.272	2464	.7065E-02	.3136E-03	29.39	26.75
7.90	.311	2493	.7775E-02	.1032E-03	32.27	29.77
9.92	.391	2459	.1841E-01	.7774E-03	34.71	31.48
11.66	.470	2494	.4766E-01	.1954E-02	36.11	33.07
11.61	.457	2917				

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TABLE D5-32

SPECIMEN NUMBER: 217-263-1
ALLOY TYPE: 2124-T851
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINT: UNSTRESSING
ENVIRONMENT: MET AIR
TEST TEMPERATURE: 299.3 K
SPECIMEN THICKNESS: 5.38 MM (0.211 IN)
MAXIMUM STRESS: 101.5 MPa (14.7 KSI)
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 18640
K(MAX): 18 CYCLES PRIOR TO FAILURE 50.85 MPa SORT(M) (46.24 KSI SORT(M))

CRACK LENGTH MM	IN	CYCLES	DELTA(A)/DELTA(H) MM/CYCLE	IN/CYCLE	DELTA(Stress Intensity) MPa SORT(M)	KSI SORT(M)
7.56	.298	1	.3387E-03	.1320E-04	10.99	10.30
8.09	.318	1559	.4946E-03	.2341E-04	11.62	11.39
8.61	.346	2752	.4977E-03	.2393E-04	11.84	10.78
9.35	.368	3872	.7261E-03	.2859E-04	12.27	11.13
10.01	.394	4878	.9522E-03	.3749E-04	12.73	11.58
10.91	.438	5933	.1047E-02	.4893E-04	13.24	12.35
11.69	.460	6283	.1798E-02	.5345E-04	13.75	12.51
12.68	.499	7007	.1327E-02	.5223E-04	14.25	12.97
13.48	.531	7813	.2085E-02	.8208E-04	14.69	13.17
14.28	.562	7990	.1955E-02	.7697E-04	15.11	13.75
15.05	.593	8391	.3281E-02	.1292E-03	15.64	14.23
16.31	.642	8775	.2628E-02	.1335E-03	16.18	14.72
17.18	.676	9107	.6726E-02	.2646E-03	16.71	15.20
18.45	.726	9296	.3795E-02	.1490E-03	17.24	15.69
19.42	.765	9551	.6281E-02	.2473E-03	17.95	16.34
21.49	.848	9881	.1080E-01	.3938E-03	18.87	17.17
23.49	.925	10081	.9255E-02	.3644E-03	19.92	17.76
24.43	.962	10182	.9760E-02	.3843E-03	19.94	18.15
25.48	1.003	10290	.1086E-01	.4198E-03	20.40	18.56
26.56	1.046	10391	.3154E-01	.1242E-02	21.15	19.25
28.08	1.145	10471	.9808E-01	.2239E-02	22.27	20.27
32.04	1.261	10523	.3117E-01	.1227E-02	23.19	21.11
33.69	1.326	10576	.5784E-01	.2246E-02	23.92	21.77
35.75	1.407	10612	.1760E+00	.6953E-02	24.88	22.64
38.97	1.519	10620				

TABLE D5-33

SPECIMEN NUMBER: 512-256-1
ALLOY TYPE: 2124-T851
SPECIMEN ORIENTATION: TRANSVERSE
CONSTRAINT: UNSTRESSING
ENVIRONMENT: MET AIR
TEST TEMPERATURE: 301.5 K
SPECIMEN THICKNESS: 6.27 MM (0.247 IN)
MAXIMUM STRESS: 219.1 MPa (31.5 KSI)
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 1775
K(MAX): 1 CYCLE PRIOR TO FAILURE 49.14 MPa SORT(M) (42.92 KSI SORT(M))

CRACK LENGTH MM	IN	CYCLES	DELTA(A)/DELTA(H) MM/CYCLE	IN/CYCLE	DELTA(Stress Intensity) MPa SORT(M)	KSI SORT(M)
6.86	.269	1	.1890E-02	.7440E-04	16.25	14.79
7.39	.291	292	.1510E-02	.5977E-04	16.74	15.27
7.77	.306	544	.2285E-02	.8999E-04	17.22	15.67
8.20	.323	732	.9936E-02	.3900E-03	17.74	16.15
8.74	.344	787	.5629E-02	.2218E-03	18.49	17.28
F 10.44	.419	1125	.6724E-02	.2647E-03	20.45	18.41
F 11.79	.464	1295	.1295E-01	.5107E-03	21.55	19.61
F 13.08	.515	1395	.1442E-01	.5833E-03	22.49	20.47
F 13.97	.550	1455	.4647E-01	.1833E-02	23.44	21.34
F 15.37	.605	1485	.1813E-01	.1583E-02	24.46	22.26
F 16.51	.650	1515	.4648E-01	.1750E-02	25.26	22.48
F 17.40	.685	1535	.1185E+00	.4687E-02	26.27	23.90
F 19.18	.755	1551	.1797E+00	.5512E-02	27.47	24.96
F 21.57	.810	1567	.3467E+00	.1757E-01	28.74	25.19
F 24.00	.945	1571	.2947E+00	.1571E-01	29.94	27.76
F 26.42	1.040	1573	.1208E+01	.4750E-01	31.10	29.31
F 31.51	1.235	1574	.4191E+01	.1692E+01	33.25	31.76

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TABLE D5-34

SPECIMEN NUMBER:			178-256-3		
ALLOY TYPE:			2124-T851		
SPECIMEN ORIENTATION:			TRANSVERSE		
CONSTRAINT:			UNSTIFFENED		
ENVIRONMENT:			NET AIR		
TEST TEMPERATURE:			23.0 K		
SPECIMEN THICKNESS:			6.50 MM (0.256 IN)		
MAXIMUM STRESS:			216.5 MPa (31.4 KSI)		
R-RATIO:			0.1		
FREQUENCY:			270 CPM		
CYCLES TO FAILURE:			2420 CYCLES		
K(MAX) 507 CYCLES PRIOR TO FAILURE:			31.88 MPa SQRT(IN) (23.1 KSI SQRT(IN))		

CRACK LENGTH	IN	CYCLES	DELTA (A)/DELTA (IN)	DELTA (STRESS INTENSIVITY)		
MM			MM/CYCLE	MPa SQRT(IN)		
3.46	.136	1	.6405E-03	.2679E-04	11.68	10.63
3.46	.155	727	.1439E-02	.4665E-04	12.47	11.93
4.75	.187	1291	.2763E-02	.1079E-03	13.65	12.42
5.32	.210	1531	.2490E-02	.1134E-03	14.53	14.23
6.09	.240	1766	.5417E-02	.2137E-03	15.46	14.11
6.89	.271	1913				

TABLE D5-35

SPECIMEN NUMBER:			178-256-1		
ALLOY TYPE:			2124-T851		
SPECIMEN ORIENTATION:			TRANSVERSE		
CONSTRAINT:			UNSTIFFENED		
ENVIRONMENT:			NET AIR		
TEST TEMPERATURE:			23.0 K		
SPECIMEN THICKNESS:			6.51 MM (0.256 IN)		
MAXIMUM STRESS:			175.5 MPa (25.4 KSI)		
R-RATIO:			0.1		
FREQUENCY:			230 CPM		
CYCLES TO FAILURE:			281 CYCLES		
K(MAX) 1 CYCLES PRIOR TO FAILURE:			55.52 MPa SQRT(IN) (51.43 KSI SQRT(IN))		

CRACK LENGTH	IN	CYCLES	DELTA (A)/DELTA (IN)	DELTA (STRESS INTENSIVITY)		
MM			MM/CYCLE	MPa SQRT(IN)		
2.26	.089	1	.6788E-02	.1845E-03	16.60	15.11
2.70	.110	114	.1644E-01	.6474E-03	17.95	16.34
3.11	.123	133	.7642E-02	.3317E-03	18.76	17.17
3.34	.132	161	.9133E-02	.4544E-03	19.56	17.90
3.68	.145	200	.8194E-02	.3226E-03	20.37	19.54
3.93	.155	231	.3416E-01	.1345E-02	21.16	19.25
4.27	.168	241	.1310E+00	.5198E-02	22.41	20.40
4.43	.174	246	.7799E-01	.3878E-02	23.66	21.93
5.32	.210	251	.3475E-01	.1368E-02	24.34	22.33
5.71	.225	262	.8892E-01	.3500E-02	26.66	24.26
7.31	.288	280				

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TABLE D5-36

SPECIMEN NUMBER						
SPECIMEN C						
TEST TEMPERATURE						
SPECIMEN TYPE						
FREQUENCY						
CYCLES TO FAILURE						
K(MAX) 100 CYCLES PRIOR TO FAILURE						
(NET STRESS GREATER THAN 2.0 PSI)						
CRACK LENGTH	CYCLES	DELTA K(I)/DELTA K(II)	DELTA STRESS INTENSITY	DELTA STRESS INTENSITY	DELTA STRESS INTENSITY	DELTA STRESS INTENSITY
IN		IN/CYCLE	PPS (MPT)	PPS (MPT)	PPS (MPT)	PPS (MPT)
0.83	489	.1329E-02	.5234E-04	27.42	24.95	
6.70	1297	.3166E-02	.1747E-03	29.11	26.49	
7.40	1742	.2199E-02	.8463E-04	30.61	27.46	
9.15	2437	.2410E-02	.9520E-04	32.12	29.23	
8.92	3072	.3783E-02	.1489E-03	34.73	31.61	
13.92	4134	.4601E-02	.1811E-03	37.31	33.95	
11.81	4522	.4896E-02	.1927E-03	38.76	35.27	
12.61	4844	.4782E-02	.1851E-03	39.95	36.36	
13.23	5113	.8594E-02	.3340E-03	43.41	39.50	
16.16	5967	.1372E-01	.5482E-03	47.37	42.82	
17.93	6118	.1014E-01	.4080E-03	48.32	43.98	
18.58	6235	.1116E-01	.4395E-03	49.36	44.98	
19.25	6370	.1676E-01	.6597E-03	50.69	46.13	
20.25	6689	.1414E-01	.5565E-03	52.55	47.83	
21.70	6695	.1460E-01	.5717E-03	54.62	49.71	
22.98	6825	.1626E-01	.6376E-03	56.57	51.48	
24.26	6983	.2802E-01	.1024E-02	58.44	53.18	
25.43	7073	.2564E-01	.1010E-02	60.76	55.29	
27.26	7216	.4770E-01	.1878E-02	63.81	58.27	
29.31	7302	.4605E-01	.1813E-02	66.15	60.20	
33.19	7340	.5224E-01	.2057E-02	68.85	61.93	
31.62	7395	.4719E-01	.1898E-02	70.61	64.26	
33.25	7464	.7597E-01	.2991E-02	75.91	69.09	
37.66	7583					
39.30	7617	.8862E-01	.3489E-02	81.64	74.30	
42.13	7675	.9778E-01	.3849E-02	86.00	78.66	

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FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

TABLE D5-37

SPECIMEN NUMBER: 1
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: 1
CONSTRAINT: 1
ENVIRONMENT: 1
TEST TEMPERATURE: 1
SPECIMEN THICKNESS: 1
MAXIMUM STRESS: 1
R-RATIO: 1
FREQUENCY: 1
CYCLES TO FAILURE: 1
(KINAR) : CYCLES PRIOR TO FAILURE

115-273-1
2124-T851
UNSTIFFENED
LAW AIR
425 K
5.44 MM (0.214 IN)
144.8 MPa (21.0 KSI)
200 KHz
7807 CYCLES
(NET STRESS GREATER THAN 0.9 FTY)

CRACK LENGTH IN	CYCLES	MM/CYCLE	IN/CYCLE	DELTA STRESS MPa (KSI)	INTENSITY KSI (MPa)
5.76	1223	.1909E-02	.7518E-04	27.58	25.10
6.92	1951	.1635E-02	.6436E-04	29.67	26.82
7.92	2679	.2916E-02	.1148E-03	31.02	29.23
8.44	3073	.2742E-02	.1744E-03	32.54	29.65
9.12	3444	.1874E-02	.1827E-03	33.99	31.74
9.93	3905	.3745E-02	.1317E-03	35.37	32.19
11.63	4122	.4374E-02	.1722E-03	36.81	34.40
11.54	4598	.6496E-02	.2754E-03	38.43	34.97
12.50	4839	.7247E-02	.2869E-03	39.97	36.18
13.38	5032	.1079E-01	.4248E-03	41.50	37.42
14.43	5219	.1004E-01	.3961E-03	43.14	39.26
14.35	5514	.6199E-02	.2519E-03	44.63	40.51
16.33	5890	.1594E-01	.7867E-03	46.67	42.47
17.46	5814	.1474E-01	.5827E-03	48.77	44.74
18.04	5051	.1433E-01	.5864E-03	50.27	45.78
19.49	6054	.1844E-01	.7259E-03	51.71	47.36
21.87	6157	.1274E-01	.7187E-03	53.06	48.29
21.77	6286	.2441E-01	.9618E-03	54.98	50.33
23.43	6777	.2971E-01	.1169E-02	57.25	52.11
24.76	6514	.4295E-01	.1491E-02	60.58	55.12
27.72	6591	.4444E-01	.1967E-02	64.77	58.48
29.60	6652	.7163E-01	.2891E-02	67.70	61.61
F 31.84	6717	.5507E-01	.2160E-02	70.72	64.36
F 33.21	6742	.9111E-01	.7483E-02	73.68	66.87
F 35.04	6777	.8866E-01	.2494E-02	76.51	69.63
F 36.59	6832	.1112E+00	.4663E-02	79.16	72.74
F 37.84	6842	.1207E+00	.6291E-02	82.54	75.11
F 40.06	6862	.1511E+00	.5945E-02	86.33	78.56
F 41.77	6894			(NET STRESS GREATER THAN 0.9 FTY)	
F 43.16	6917			(NET STRESS GREATER THAN 0.9 FTY)	
F 45.20	6932			(NET STRESS GREATER THAN 0.9 FTY)	
F 46.76	6947			(NET STRESS GREATER THAN 0.9 FTY)	
F 48.86	6957			(NET STRESS GREATER THAN 0.9 FTY)	
F 49.93	6967			(NET STRESS GREATER THAN 0.9 FTY)	
F 50.68	6974			(NET STRESS GREATER THAN 0.9 FTY)	
F 52.99	6986			(NET STRESS GREATER THAN 0.9 FTY)	
F 54.48	6994			(NET STRESS GREATER THAN 0.9 FTY)	
F 55.05	6996			(NET STRESS GREATER THAN 0.9 FTY)	
F 57.99	6998			(NET STRESS GREATER THAN 0.9 FTY)	
F 60.57	6999			(NET STRESS GREATER THAN 0.9 FTY)	
F 62.43	6999			(NET STRESS GREATER THAN 0.9 FTY)	
F 65.83	6999			(NET STRESS GREATER THAN 0.9 FTY)	
F 67.32	7000			(NET STRESS GREATER THAN 0.9 FTY)	
F 70.25	7001			(NET STRESS GREATER THAN 0.9 FTY)	
F 72.38	7001			(NET STRESS GREATER THAN 0.9 FTY)	

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SPECIMEN NUMBER
SPECIMEN COUNTRY
TEST
SPECIMEN TISSUE

212-253-2
 1912-1222
 LONG
 UNST
 4.41 MM 1.23
 100.4 MPA 115.0 KSI
 200
 17499
 1 42-84 KSI 5011

K(MAN) 614 CYCLES PRIOR TO FAILURE

51.67 MPa SORT(M) 44.84 ksi SORT(M)

CHUCK	LENGTH	CYCLES	DELTA (A) DELTA (B)		DELTA STRESS	INTENSITY
			MM/CYCLE	IN/CYCLE		
7.29	.285	1	.0692E-03	.2241E-04	16.38	14.94
8.64	.308	2451	.7537E-03	.2967E-04	17.78	16.18
10.07	.306	6349	.8931E-03	.3302E-04	19.82	17.38
11.49	.445	5765	.1999E-02	.4312E-04	20.38	18.95
13.28	.928	7513	.1294E-02	.5894E-04	21.71	19.75
14.51	.971	8921	.1769E-02	.6929E-04	22.57	20.34
15.41	.667	9829	.1688E-02	.6644E-04	23.28	21.12
16.16	.636	9676	.1734E-02	.6425E-04	23.78	21.64
16.94	.667	9928	.1739E-02	.6831E-04	24.37	22.18
17.79	.700	10414	.2677E-02	.1054E-03	25.84	22.79
18.81	.748	10795	.1995E-02	.7855E-04	25.98	23.84
20.49	.889	11628	.2207E-02	.1066E-03	27.03	24.60
21.92	.863	12161	.3002E-02	.1213E-03	28.80	25.45
23.38	.921	12637	.3325E-02	.1945E-03	29.12	26.58
25.37	.999	13143	.3315E-02	.1389E-03	30.22	27.58
26.87	1.058	13595	.4156E-02	.1634E-03	31.18	28.38
28.98	1.122	13987	.4887E-02	.1849E-03	32.17	29.27
30.18	1.185	14321	.5661E-02	.2229E-03	33.17	30.18
31.84	1.254	14629	.6159E-02	.2425E-03	34.85	30.99
33.08	1.382	14829	.8158E-02	.2424E-03	34.89	31.75
34.73	1.367	15897	.8163E-02	.3371E-03	35.86	32.64
36.42	1.434	15295	.7596E-02	.2998E-03	36.81	33.58
38.88	1.496	15983	.9413E-02	.3786E-03	37.73	34.34
39.65	1.561	15678				
41.88	1.661	15883	.9518E-02	.3985E-03	38.79	35.38
43.95	1.695	15979	.1421E-01	.5594E-03	35.75	36.18
45.16	1.778	16147	.1257E-01	.4949E-03	40.74	37.08
46.71	1.839	16267	.1291E-01	.5083E-03	41.79	38.03
48.61	1.914	16398	.1449E-01	.5786E-03	42.77	38.93
50.30	1.969	16482	.1668E-01	.8568E-03	43.72	39.79
51.91	2.344	16589	.1782E-01	.7814E-03	44.64	40.66
53.35	2.121	16665	.1898E-01	.7474E-03	45.85	41.54
55.22	2.174	16762	.1919E-01	.7557E-03	46.62	42.42
56.53	2.226	16827	.2824E-01	.7969E-03	47.55	43.28
58.11	2.288	16885	.2728E-01	.1074E-02	48.62	44.86

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CK LENGTH IN	CYCLES	DELTA(I)/DELTA(II) MN/CYCLE	DELTA(III)/DELTA(IV) MN/CYCLE	DELTA(II) STRESS PSI (SQT IN)	INTENSITY KSI (SQT IN)
.097	603	.0893E-03	.3383E-04	19.19	17.46
.119	1034	.1699E-02	.6531E-04	21.28	19.37
.147	1444	.1629E-02	.6413E-04	23.37	21.27
.174	1731	.2194E-02	.8638E-04	25.18	22.92
.199	2027	.3919E-02	.1184E-03	27.13	24.69
.233	2177	.4891E-02	.1910E-03	27.85	26.43
.262	2339	.3598E-02	.1571E-03	30.60	27.85
.287	2491	.4666E-02	.1829E-03	32.86	29.10
.315	2619	.6303E-02	.2363E-03	33.58	30.56
.345	2728	.5484E-02	.2159E-03	34.93	31.78
.368	2867	.5233E-02	.2060E-03	36.19	32.94
.397	2973	.7681E-02	.2784E-03	37.97	34.19
.427	3051	.8494E-02	.3366E-03	38.43	35.34
.453	3183	.1280E-01	.5938E-03	39.99	36.39
.479	3158	.1344E-01	.5291E-03	41.18	37.47
.508	3237	.1233E-01	.4894E-03	42.99	38.75
.547	3287	.1489E-01	.5538E-03	43.93	39.97
.574	3334	.1432E-01	.5638E-03	45.90	40.95
.601	3370	.2205E-01	.8681E-03	46.12	41.97
.632	3400	.2642E-01	.1040E-02	47.31	43.08
.663	3436	.2474E-01	.1093E-02	48.56	44.19
.699	3464	.2350E-01	.9263E-03	49.72	45.25
.727	3487	.3233E-01	.1281E-02	50.74	46.17
.756					
.797	3420	.3144E-01	.1238E-02	51.97	47.29
.827	3547	.3884E-01	.1497E-02	53.20	48.41
.851	3556	.3826E-01	.1586E-02	54.12	49.25
.891	3574	.5487E-01	.2239E-02	55.20	50.24
.929	3596	.6433E-01	.1769E-02	56.51	51.43
.962	3615	.5478E-01	.2197E-02	57.67	52.44
1.025	3639	.5738E-01	.2259E-02	59.21	53.88
1.095	3669	.5988E-01	.2888E-02	61.16	55.66
1.120	3684	.5527E-01	.2333E-02	62.64	57.08
1.170	3699	.8467E-01	.3333E-02	63.95	58.19
1.220	3714	.8467E-01	.3333E-02	65.67	59.58
1.290	3729	.1188E-00	.4667E-02	67.28	61.22
1.360	3744	.1188E-00	.4667E-02	69.36	63.12
1.415	3754	.1143E-00	.4589E-02	71.37	64.64
1.466	3764	.1397E-00	.5588E-02	72.82	66.08
1.525	3774	.1491E-00	.6588E-02	74.27	67.59
1.605	3784	.2832E-00	.8008E-02	76.37	69.59
1.650	3789	.2286E-00	.9888E-02	78.12	71.15
1.708	3794	.2540E-00	.1088E-01	79.95	72.48
1.750	3799	.2540E-00	.1088E-01	81.38	73.71
1.805	3804	.2794E-00	.1188E-01	82.52	75.09
1.885	3819	.4384E-00	.1488E-01	84.67	76.87
1.970	3816	.4319E-00	.1788E-01	86.87	79.05
2.045	3817				

(NET STRESS GREATER THAN 8.9 FTY)

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CK LENGTH	CYCLES	DELTA STRESS / DELTA TIME MPA/CYCLE	DELTA STRESS / DELTA TIME IN/CYCLE	DELTA STRESS PPA SORTIN	INTENSITY ESI SORTIN
0.89	1	.2666E-02	.1892E-03	24.03	25.91
.132	313	.4137E-02	.1624E-03	21.71	29.06
.163	507	.6281E-02	.2465E-03	24.06	31.02
.195	636	.7774E-02	.2903E-03	27.00	34.40
.223	724	.8299E-02	.3250E-03	46.53	36.00
.257	830	.1264E-01	.6994E-03	43.64	39.71
.330	923	.1749E-01	.7671E-03	60.29	42.10
.324	950				
.307	1049		(NET STRESS GREATER THAN 0.9 FTV)		
.419	1092		(NET STRESS GREATER THAN 0.9 FTV)		
.455	1133		(NET STRESS GREATER THAN 0.9 FTV)		
.486	1160		(NET STRESS GREATER THAN 0.9 FTV)		
.511	1199		(NET STRESS GREATER THAN 0.9 FTV)		
.525	1212		(NET STRESS GREATER THAN 0.9 FTV)		
.566	1242		(NET STRESS GREATER THAN 0.9 FTV)		
.615	1277		(NET STRESS GREATER THAN 0.9 FTV)		
.665	1297		(NET STRESS GREATER THAN 0.9 FTV)		
.705	1297		(NET STRESS GREATER THAN 0.9 FTV)		
.735	1294		(NET STRESS GREATER THAN 0.9 FTV)		
.809	1302		(NET STRESS GREATER THAN 0.9 FTV)		
.845	1307		(NET STRESS GREATER THAN 0.9 FTV)		
.890	1312		(NET STRESS GREATER THAN 0.9 FTV)		
.960	1316		(NET STRESS GREATER THAN 0.9 FTV)		
1.025	1319		(NET STRESS GREATER THAN 0.9 FTV)		
1.070	1321		(NET STRESS GREATER THAN 0.9 FTV)		
1.150	1323		(NET STRESS GREATER THAN 0.9 FTV)		
1.200	1324		(NET STRESS GREATER THAN 0.9 FTV)		
1.255	1325		(NET STRESS GREATER THAN 0.9 FTV)		
1.330	1326		(NET STRESS GREATER THAN 0.9 FTV)		

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2024-T861 AND 2124-T851

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TABLE D5-41

SPECIMEN NUMBER: 270-283-1
SLOT TYPE: TRANSVERSE
SPECIMEN ORIENTATION: UNSTRESSING
CONSTRAINT: 100%
TEST TEMPERATURE: 100°F
SPECIMEN THICKNESS: 6.44 MM (0.253 IN)
NATURAL STRESS: 109.0 MPA (15.8 KSI)
FREQUENCY: 200 CPS
CYCLES TO FAILURE: 10000
KIMAX: 516 CYCLES PRIOR TO FAILURE 42.21 MPA SORTIME 34.42 KSI SORTIME

CRACK LENGTH MM	IN	CYCLES	DELTA (A)/DELTA (N) MM/CYCLE	IN/CYCLE	DELTA (STRESS INTENSITY) MPA SORTIME KSI SORTIME
6.49	.255	1	.4032E-03	.1932E-04	15.68 14.27
7.59	.299	1239	.5242E-03	.2364E-04	16.73 14.96
8.20	.323	2414	.6490E-03	.3366E-04	17.05 15.92
9.20	.356	3354	.1104E-02	.4764E-04	17.87 16.27
9.89	.389	4199	.1234E-02	.4874E-04	18.79 17.10
10.97	.432	5532	.1355E-02	.5315E-04	19.61 17.70
11.45	.455	5463	.1733E-02	.6812E-04	20.18 18.36
12.46	.491	5987	.2145E-02	.8445E-04	20.87 19.00
13.20	.521	6331	.2562E-02	.1008E-03	21.57 19.61
14.17	.558	6713	.2454E-02	.9861E-04	22.19 20.19
14.75	.581	6966	.2526E-02	.9943E-04	22.84 21.79
15.86	.625	7388	.3789E-02	.1440E-03	23.55 21.43
16.60	.654	7587	.4575E-02	.1881E-03	24.44 22.24
16.70	.671	7959	.4965E-02	.1955E-03	25.33 23.95
19.08	.751	8115	.4175E-02	.1684E-03	26.34 24.79
21.63	.812	8487	.4165E-02	.1222E-03	27.29 24.46
22.49	.885	8714	.8641E-02	.1414E-03	28.51 25.94
24.34	.959	8927	.5644E-02	.1221E-03	29.47 26.74
26.78	.999	9111	.1771E-01	.6973E-03	30.34 27.65
27.36	1.077	9221	.1094E-01	.4533E-03	31.44 28.72
29.22	1.142	9424	.1399E-01	.6538E-03	32.64 29.74
31.09	1.222	9535	.2186E-01	.4426E-03	33.86 31.82
33.21	1.308	9734	.1403E-01	.6311E-03	35.17 31.94
35.25	1.388	9761	.2072E-01	.7994E-03	36.14 32.91
36.89	1.452	9842	.2106E-01	.8292E-03	37.24 33.71
39.13	1.542	9949	.7527E-01	.9944E-03	38.44 35.2
41.07	1.617	10025	.7594E-01	.1416E-02	39.57 36.01
42.94	1.691	10077			

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FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

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TABLE D5-42

SPECIMEN NUMBER:				2124-T851			
ALLOY TYPE:				2124-T851			
SPECIMEN ORIENTATION:				TRANSVERSE			
CONSTRAINTS:				UNSTIFFENED			
ENVIRONMENT:				LAB AIR			
TEST TEMPERATURE:				68.0 F			
SPECIMEN THICKNESS:				0.40 MM (0.0157 IN)			
MAXIMUM STRESS:				57.12 MPA (8291 PSI)			
R-RATIO:				0.5			
FREQUENCY:				200 CPM			
CYCLES TO FAILURE:				2560 CYCLES			
K(MAX): 68 CYCLES PRIOR TO FAILURE:				57.12 MPA (8291 PSI) 51.94 KSI (8291 PSI)			

CRACK LENGTH	MM	IN	CYCLES	DELTA (A1)/DELTA (A2)	MM/CYCLE	IN/CYCLE	DELTA (STRESS INTENSITY)	MPA (SQRT IN)	KSI (SQRT IN)
2.37	.093		1	.1059E-02	.01059E-04		19.14	17.42	
3.11	.122		697	.1505E-02	.0001505E-04		21.66	19.70	
4.00	.154		1221	.2727E-02	.0002727E-03		23.99	21.83	
4.70	.184		1513	.1043E-02	.0001043E-04		25.86	23.53	
5.29	.208		1664	.5931E-02	.0005931E-03		27.49	25.31	
5.99	.236		1785	.6761E-02	.0006761E-03		29.32	26.69	
6.05	.239		1912	.7265E-02	.0007265E-03		31.04	28.24	
7.52	.296		2005	.9055E-02	.0009055E-03		32.58	29.65	
8.31	.327		2084	.1199E-01	.001199E-03		33.94	31.32	
8.90	.350		2134	.1174E-01	.001174E-03		35.13	31.97	
9.48	.373		2183	.1514E-01	.001514E-03		36.39	33.12	
10.23	.403		2231	.2275E-01	.002275E-03		37.82	34.40	
11.61	.463		2267	.1774E-01	.001774E-03		38.97	35.47	
11.56	.455		2298	.2624E-01	.002624E-03		39.96	36.37	
12.15	.478		2319	.4374E-01	.004374E-03		41.06	37.36	
12.85	.506		2335	.6176E-01	.006176E-03		42.22	38.42	
13.56	.534		2352	.3774E-01	.003774E-03		43.43	39.52	
F 14.35	.565		2373	.2963E-01	.002963E-03		44.76	40.72	
F 15.24	.600		2433	.4657E-01	.004657E-03		46.49	42.31	
F 16.84	.665		2433	.6652E-01	.006652E-03		48.55	44.18	
F 18.03	.710		2454	.5292E-01	.005292E-03		50.46	45.91	
F 19.30	.760		2478	.8467E-01	.008467E-03		52.21	47.51	
F 20.57	.810		2493	.1111E+00	.01111E-02		53.67	48.84	
F 21.46	.845		2501						

TABLE D5-43

SPECIMEN NUMBER:				2124-T851		
ALLOY TYPE:				2124-T851		
SPECIMEN ORIENTATION:				TRANSVERSE		
CONSTRAINTS:				UNSTIFFENED		
ENVIRONMENT:				LAB AIR		
TEST TEMPERATURE:				68.0 F		
SPECIMEN THICKNESS:				0.32 MM (0.0126 IN)		
MAXIMUM STRESS:				337.7 MPA (48.6 KSI)		
R-RATIO:				0.5		
FREQUENCY:				200 CPM		
CYCLES TO FAILURE:				518 CYCLES		
K(MAX): 1 CYCLES PRIOR TO FAILURE:				(NET STRESS GREATER THAN 3.9 FTY)		

CRACK LENGTH	MM	IN	CYCLES	DELTA (A1)/DELTA (A2)	MM/CYCLE	IN/CYCLE	DELTA (STRESS INTENSITY)	MPA (SQRT IN)	KSI (SQRT IN)
3.00	.118		1	.1273E-01	.001273E-03		29.82	27.14	
3.62	.143		51	.6510E-02	.0006510E-04		32.50	29.66	
4.29	.169		197	.6449E-02	.0006449E-04		35.22	32.36	
4.98	.195		307	.1187E-01	.001187E-03		37.40	34.94	
5.46	.214		343	.3711E-01	.003711E-03		40.04	36.44	
6.46	.254		373	.1312E-01	.001312E-03		42.60	39.77	
7.03	.277		386	.1317E+00	.01317E-02		51.43	46.78	
F 12.56	.495		424				(NET STRESS GREATER THAN 3.9 FTY)		
F 13.72	.542		459				(NET STRESS GREATER THAN 3.9 FTY)		
F 16.51	.650		474				(NET STRESS GREATER THAN 3.9 FTY)		
F 18.41	.725		491				(NET STRESS GREATER THAN 3.9 FTY)		
F 21.57	.850		531				(NET STRESS GREATER THAN 3.9 FTY)		
F 24.51	.965		513				(NET STRESS GREATER THAN 3.9 FTY)		
F 26.42	1.050		516				(NET STRESS GREATER THAN 3.9 FTY)		
F 29.34	1.159		516				(NET STRESS GREATER THAN 3.9 FTY)		
F 31.57	1.240		517				(NET STRESS GREATER THAN 3.9 FTY)		

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TABLE D5-44

SPECIMEN NUMBER							217-256-2	
SPECIMEN ORIENTATION							217-256-2	
CONSTRAINTS							217-256-2	
TEST ENVIRONMENT							217-256-2	
SPECIMEN THICKNESS							217-256-2	
MAXIMUM STRESS							217-256-2	
FREQUENCY							217-256-2	
CYCLES TO FAILURE							217-256-2	
K(MAN) OR CYCLES PRIOR TO FAILURE							217-256-2	
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TABLE D5-45

SPECIMEN NUMBER			413-259-3			
SPECIMEN CONFIGURATION			LONGITUDINAL			
TEST CONFIGURATION			UNSTIFFENED			
TEST CONFIGURATION			LAB 510			
SPECIMEN THICKNESS			6.32 MM (0.249 IN)			
MAXIMUM STRESS			307.5 MPa (44.6 KSI)			
CYCLES TO FAILURE			280			
KIMANI 1 CYCLES PRIOR TO FAILURE			(NET STRESS GREATER THAN 0.9 FTY)			
CRACK LENGTH	CYCLES	DELTA (A)/DELTA (M)	DELTA STRESS	TENSILE		
IN		MM/CYCLE	IN/CYCLE	MPa (10 ³ PSI)	MPa (10 ³ PSI)	
3.32	119	.1203E-02	.9091E-04	15.74	14.33	
3.65	447	.1769E-02	.6964E-04	17.29	15.74	
4.40	913	.3161E-02	.1244E-03	18.88	17.11	
5.11	1134	.3834E-02	.1518E-03	20.82	18.22	
5.67	1295	.4102E-02	.1619E-03	21.15	19.25	
6.35	1450	.4211E-02	.1658E-03	22.36	20.35	
7.08	1624	.8909E-02	.3398E-03	23.65	21.52	
7.91	1724	.1128E-01	.4442E-03	24.94	22.74	
8.22	1802					
10.12	1891			(NET STRESS GREATER THAN 0.9 FTY)		
10.59	1941			(NET STRESS GREATER THAN 0.9 FTY)		
11.48	1975			(NET STRESS GREATER THAN 0.9 FTY)		
12.23	2017			(NET STRESS GREATER THAN 0.9 FTY)		
13.11	2059			(NET STRESS GREATER THAN 0.9 FTY)		
13.71	2079			(NET STRESS GREATER THAN 0.9 FTY)		
14.22	2088			(NET STRESS GREATER THAN 0.9 FTY)		
F 15.17	2134			(NET STRESS GREATER THAN 0.9 FTY)		
F 17.02	2173			(NET STRESS GREATER THAN 0.9 FTY)		
F 18.16	2224			(NET STRESS GREATER THAN 0.9 FTY)		
F 19.55	2254			(NET STRESS GREATER THAN 0.9 FTY)		
F 20.07	2284			(NET STRESS GREATER THAN 0.9 FTY)		
F 21.34	2314			(NET STRESS GREATER THAN 0.9 FTY)		
F 22.96	2334			(NET STRESS GREATER THAN 0.9 FTY)		
F 24.30	2354			(NET STRESS GREATER THAN 0.9 FTY)		
F 25.15	2364			(NET STRESS GREATER THAN 0.9 FTY)		
F 26.67	2384			(NET STRESS GREATER THAN 0.9 FTY)		
F 27.48	2394			(NET STRESS GREATER THAN 0.9 FTY)		
F 28.61	2434			(NET STRESS GREATER THAN 0.9 FTY)		
F 29.84	2484			(NET STRESS GREATER THAN 0.9 FTY)		
F 31.28	2414			(NET STRESS GREATER THAN 0.9 FTY)		
F 32.64	2420			(NET STRESS GREATER THAN 0.9 FTY)		
F 33.91	2421			(NET STRESS GREATER THAN 0.9 FTY)		
F 34.92	2422			(NET STRESS GREATER THAN 0.9 FTY)		
F 37.38	2423			(NET STRESS GREATER THAN 0.9 FTY)		

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FRACTURE MECHANICS DATA FOR
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TABLE D5-46

SPECIMEN NUMBER ALLOY TYPE SPECIMEN ORIENTATION CONSTRAINT EQUIPMENT TEST TEMPERATURE SPECIMEN THICKNESS MAXIMUM STRESS FREQUENCY CYCLES TO FAILURE (MIN) 16 CYCLES PRIOR TO FAILURE				211-246-3 2124-T851 TRANSVERSE UNSTRESSING LBN STM 45 C 0.40 MM (1.252 IN) 217.5 MPA (31.5 KSI) 30 200 915 CYCLES (NET STRESS GREATER THAN 1.0 FTY)			
SPACK LENGTH IN	IN	CYCLES	MM/CYCLE	IN/CYCLE	DELTA (STRESS INTENSITY) MPA SQRT (IN)	DELTA (STRESS INTENSITY) KSI SQRT (IN)	
2.57	.131	1	.4564E-03	.1795E-04	10.82	9.85	
3.74	.147	2558	.7818E-03	.3078E-04	12.74	11.63	
5.07	.200	4252	.1150E-02	.4526E-04	14.10	12.91	
5.77	.227	4871	.1435E-02	.6044E-04	14.93	13.59	
6.23	.245	5164	.1771E-02	.5399E-04	15.64	14.23	
6.94	.273	5682	.2005E-02	.4073E-04	16.40	14.92	
7.51	.297	5941	.2093E-02	.4238E-04	17.00	15.71	
9.11	.359	6895	.3269E-02	.1285E-03	14.70	17.02	
9.67	.381	6864	.3534E-02	.1391E-03	19.35	17.61	
10.43	.411	7042	.3814E-02	.1503E-03	20.03	18.23	
11.07	.436	7250	.3787E-02	.1491E-03	20.61	18.74	
11.69	.460	7411	.4111E-02	.1619E-03	21.19	19.24	
12.24	.485	7569	.5991E-02	.2752E-03	21.81	19.85	
13.11	.516	7803	.5533E-02	.2178E-03	22.45	20.43	
13.82	.544	7809	.1044E-01	.4268E-03	23.07	21.09	
14.57	.574	7874	.8253E-02	.3248E-03	23.78	21.66	
15.57	.613	7999	.4146E-02	.1207E-03	24.84	22.42	
16.71	.658	8134	.4052E-02	.1914E-03	25.20	22.93	
F 17.02	.673	8202	.9334E-02	.1676E-03	25.56	23.26	
F 17.45	.695	8271	.4893E-02	.3500E-03	26.14	23.74	
F 18.44	.730	8371	.1651E-01	.6500E-03	27.08	24.64	
F 20.14	.795	8471	.1733E-01	.4414E-03	28.35	25.45	
F 22.10	.870	8541	.1814E-01	.7143E-03	29.44	26.40	
F 23.37	.920	8651	.1547E-01	.6250E-03	30.10	27.19	
F 24.00	.945	8691	.2222E-01	.4740E-03	30.62	27.96	
F 24.89	.980	8731	.4762E-01	.1475E-02	31.54	28.70	
F 26.82	1.055	8771	.5040E-01	.2000E-02	32.82	29.87	
F 28.81	1.115	8811	.1387E-01	.1333E-02	33.74	30.75	
F 29.84	1.175	8841	.2541E-01	.1000E-02	34.59	31.44	
F 31.37	1.235	8931	.6773E-01	.2667E-02	35.70	32.44	
F 33.43	1.315	8931	.1525E-01	.7750E-02	36.91	33.59	
F 35.31	1.393	8951	.7112E-01	.2873E-02	38.03	34.41	
F 37.64	1.460	8974	.3175E-01	.1250E-02	38.76	35.27	
F 37.72	1.445	8996	.5840E-01	.2000E-02	39.31	35.80	
F 38.94	1.535	9021	.7820E-01	.3000E-02	40.17	36.56	
F 40.51	1.595	9041	.4255E-01	.7250E-02	41.13	37.43	
F 42.16	1.643	9031	.1101E+01	.4333E-02	42.41	38.74	
F 45.47	1.793	9091	.1524E+01	.6100E-02	44.29	40.70	
F 47.75	1.840	9116	.1624E+01	.6000E-02	45.43	41.35	
F 49.24	1.940	9116	.1411E+01	.5544E-02	46.24	42.12	
F 50.55	1.990	9125					
F 51.82	2.044	9132					
F 57.72	2.115	9137					

(NET STRESS GREATER THAN 1.0 FTY)
(NET STRESS GREATER THAN 1.0 FTY)

ORIGINAL PAGE IS
OF POOR QUALITY

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SPECIMEN NUMBER:
ALLOY TYPE:
SPECIMEN ORIENTATION:
CONSTRAINT:
ENVIRONMENT:
TEST TEMPERATURE:
SPECIMEN THICKNESS:
MAXIMUM STRESS:
R-RATIO:
FREQUENCY:
CYCLES TO FAILURE:

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271-259-2
2126-1851
TRANSVERSE
UNSTIFFENED
LBM AYR
450.8 K
6.43 MM (0.2530 IN)
307.6 MPa (44.6 KSI)
200 CPM
2013 CYCLES

	CRACK LENGTH		CYCLES	DELTA (A)/DELTA (IN)		DELTA (STRESS)		INTENSITY KSI SORT (IN)
	MM	IN		MM/CYCLE	IN/CYCLE	HPS	TSI SORT (IN)	
	2.94	.100	1					
	3.17	.125	567	.1124E-02	.4426E-04	14.56		17.25
	3.88	.153	815	.2063E-02	.1127E-03	16.19		14.73
	4.77	.188	102E	.4183E-02	.1847E-03	17.93		16.32
	9.35	.211	1135	.7395E-02	.2911E-03	19.39		17.85
	6.45	.254	1246	.7808E-02	.3071E-03	20.95		19.77
	7.29	.287	1350	.8108E-02	.3192E-03	22.62		20.50
	8.10	.319	1465	.6991E-02	.2752E-03	23.94		21.79
	8.86	.349	1517	.1488E-01	.5750E-03	25.14		22.88
	9.67	.381	1685			(NET STRESS GREATER THAN 3.9 FTY)		
	10.38	.409	1683			(NET STRESS GREATER THAN 3.9 FTY)		
	11.12	.438	1743			(NET STRESS GREATER THAN 3.9 FTY)		
	11.89	.468	1791			(NET STRESS GREATER THAN 3.9 FTY)		
	12.69	.508	1834			(NET STRESS GREATER THAN 3.9 FTY)		
	13.79	.543	1877			(NET STRESS GREATER THAN 3.9 FTY)		
	14.41	.567	1910			(NET STRESS GREATER THAN 3.9 FTY)		
F	17.82	.678	1938			(NET STRESS GREATER THAN 3.9 FTY)		
F	18.88	.748	1963			(NET STRESS GREATER THAN 3.9 FTY)		
F	20.78	.815	1988			(NET STRESS GREATER THAN 3.9 FTY)		
F	21.97	.885	1998			(NET STRESS GREATER THAN 3.9 FTY)		
F	23.11	.918	2016			(NET STRESS GREATER THAN 3.9 FTY)		
F	25.48	1.080	3012			(NET STRESS GREATER THAN 3.9 FTY)		

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TABLE D5-48

SPECIMEN NUMBER				11-233-6		
SPECIMEN ORIENTATION				LONGITUDINAL		
TEST TEMPERATURE				140.0 MPa (21.0 KSI)		
SPECIMEN THICKNESS				6.53 MM (.257 IN)		
MAXIMUM STRESS				200 MPa		
CYCLES TO FAILURE				8499 CYCLES		
K(MAX) 67% CYCLES PRIOR TO FAILURE				(NET STRESS GREATER THAN 3.9 FTY)		
CPACK	LFNGTH	CYCLES	DELTA (A1)/DELTA (A2)		DELTA STRESS INTENSITY	
MM	IN		MM/CYCLE	IN/CYCLE	MPa SQRT (IN)	KSI SQRT (IN)
5.69	.448	1047	.1800E-02	.6219E-04	27.05	24.62
6.51	.513	1636	.2569E-02	.1011E-03	28.74	26.16
7.24	.570	2222	.2699E-02	.1047E-03	30.35	27.62
8.06	.634	3421	.3707E-02	.1499E-03	33.32	31.33
11.28	.889	3761	.4416E-02	.1739E-03	36.05	32.80
11.63	.909	4018	.5685E-02	.2210E-03	37.35	33.99
11.76	.926	4747	.6203E-02	.2457E-03	38.59	35.12
12.48	.982	4718	.6453E-02	.2697E-03	39.84	36.26
13.25	1.043	4894	.6718E-02	.2880E-03	41.12	37.42
14.72	1.164	5056	.7042E-02	.3109E-03	42.29	38.49
14.70	1.157	5264	.6827E-02	.2580E-03	43.28	39.78
16.25	1.261	5424	.1114E-01	.4147E-03	44.56	41.05
16.31	1.284	5624	.0797E-02	.3060E-03	46.33	42.16
17.52	1.398	5827	.1024E-01	.4133E-03	48.38	44.32
18.97	1.493	6133	.1120E-01	.4411E-03	50.78	46.18
21.63	1.704	6332	.1471E-01	.5789E-03	53.28	48.49
22.31	1.757	6573	.1744E-01	.6892E-03	56.15	51.10
24.41	1.922	6719	.1837E-01	.7211E-03	58.78	53.90
25.75	2.028	7002	.2214E-01	.8718E-03	61.07	56.51
27.28	2.144	7602	.2492E-01	.9809E-03	64.46	59.61
30.08	2.369	7229	.1737E-01	.6721E-03	67.94	61.47
31.17	2.454	7392	.1743E-01	.1718E-02	71.01	64.62
34.23	2.646	7512	.1747E-01	.1475E-02	75.67	69.86
36.47	2.872	7641	.1992E-01	.1972E-02	80.21	72.99
39.09	3.178	7828	.4594E-01	.1609E-02	87.19	79.35
43.36	3.412	7851				
44.11	3.473	7855				
44.68	3.676	8225				
49.01	3.859					

(NET STRESS GREATER THAN 3.9 FTY)
(NET STRESS GREATER THAN 3.9 FTY)
(NET STRESS GREATER THAN 3.9 FTY)

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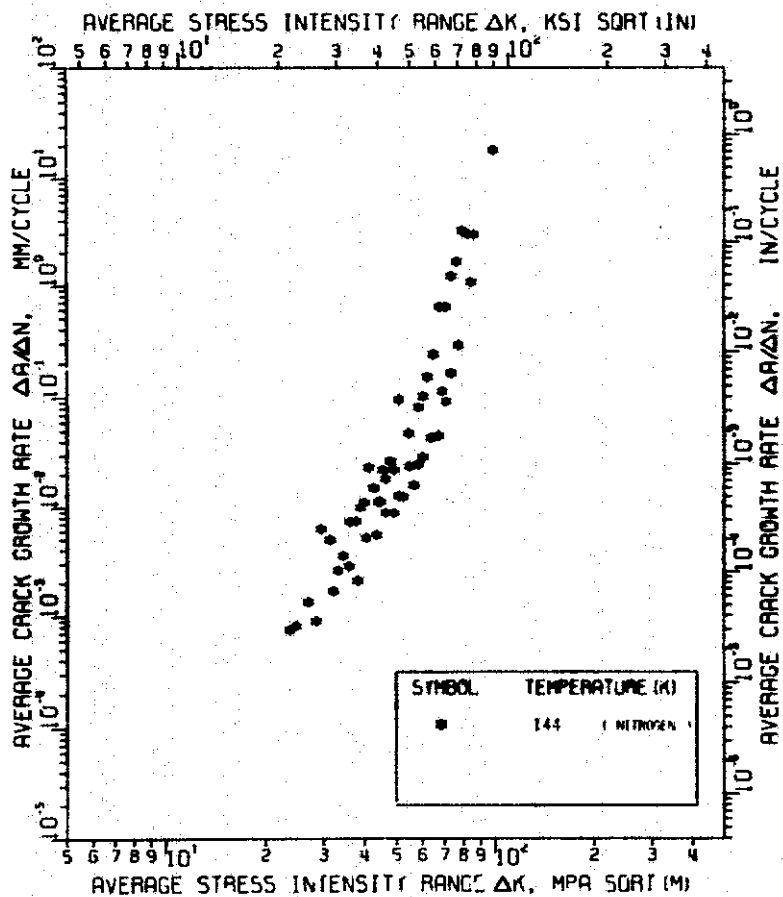
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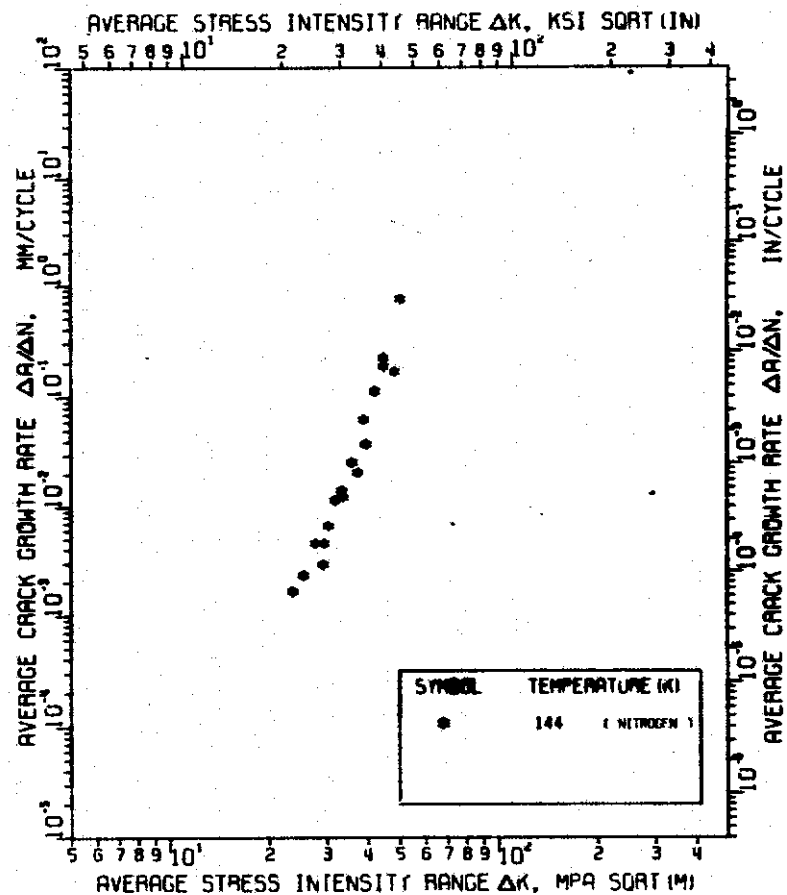
TABLE D5-49

SPECIMEN NUMBER:			274-253-6		
ALLOY TYPE:			2024-T861		
SPECIMEN ORIENTATION:			TENSILE		
CONSTRAINTS:			UNSTRESS		
ENVIRONMENT:			LAB AIR		
TEST TEMPERATURE:			27°C		
SPECIMEN THICKNESS:			6.48 MM (0.255 IN)		
MAXIMUM STRESS:			140.2 MPa (21.3 KSI)		
R-RATIO:			200		
FREQUENCY:			7300 CYCLES		
CYCLES TO FAILURE:			(NET STRESS GREATER THAN 0.9 FTY)		
K(MAX) 237					
CRACK LENGTH	IN	CYCLES	DELTA(S)/DELTA(M)	DELTA(STRESS INTENSITY)	
MM			MM/CYCLE	MPA SQRT(M)	KSI SQRT(IN)
6.08	.479	1	.149E-02	.649E-04	27.45
6.46	.506	103F	.264E-02	.1040E-03	29.62
7.04	.617	1721	.1979E-02	.1366E-03	31.59
8.69	.684	2146	.1596E-02	.6242E-04	32.7C
8.99	.708	2522	.4521E-02	.1702E-03	33.69
9.73	.766	2852	.6876E-02	.1920E-03	35.44
10.09	.858	3327	.3360E-02	.1323E-03	36.69
11.14	.877	3477	.5964E-02	.2344E-03	37.63
11.97	.943	3756	.5543E-02	.2142E-03	38.87
12.59	.991	3977	.5891E-02	.2319E-03	40.04
13.42	1.057	4261	.9562E-02	.3765E-03	41.4C
14.19	1.117	4421	.5393E-02	.2122E-03	42.87
15.24	1.230	4811	.8612E-02	.3190E-03	44.59
16.36	1.288	5071	.8479E-02	.3338E-03	46.96
18.28	1.419	5524	.1725E-01	.6791E-03	49.50
19.66	1.544	5684	.1773E-01	.6893E-03	51.18
20.49	1.616	5819	.1444E-01	.5699E-03	52.51
21.42	1.696	5947	.1257E-01	.4291E-03	53.55
21.86	1.721	6029	.1274E-01	.1290E-02	54.94
23.25	1.831	6114	.1711E-01	.6745E-03	57.17
24.79	1.952	6294	.4087E-01	.1609E-02	59.43
26.27	2.063	6367	.3360E-01	.1131E-02	61.39
27.32	2.151	6429	.3062E-01	.1204E-02	63.25
28.67	2.290	6511	.3207E-01	.1294E-02	65.17
29.67	2.336	6578	.4723E-01	.1859E-02	67.19
31.11	2.453	6639	.4923E-01	.1939E-02	69.06
31.61	2.599	6716	.4447E-01	.1751E-02	74.50
36.34	2.862	8866	.1051E+01	.4117E-02	80.23
39.18	3.105	6923	.8442E-01	.3432E-02	94.91
41.04	3.231	6951	.1303E+02	.4265E-02	90.04
43.91	3.457	7016			
46.42	3.655	7058			
49.68	3.912	7093			
			(NET STRESS GREATER THAN 1.9 FTY)		
			(NET STRESS GREATER THAN 0.9 FTY)		

(a) Longitudinal



(b) Transverse



Alloy: 2124-T851

Stress Ratio: .05

Frequency: 200 cpm

Thickness: 6.35 mm (.250 inch)

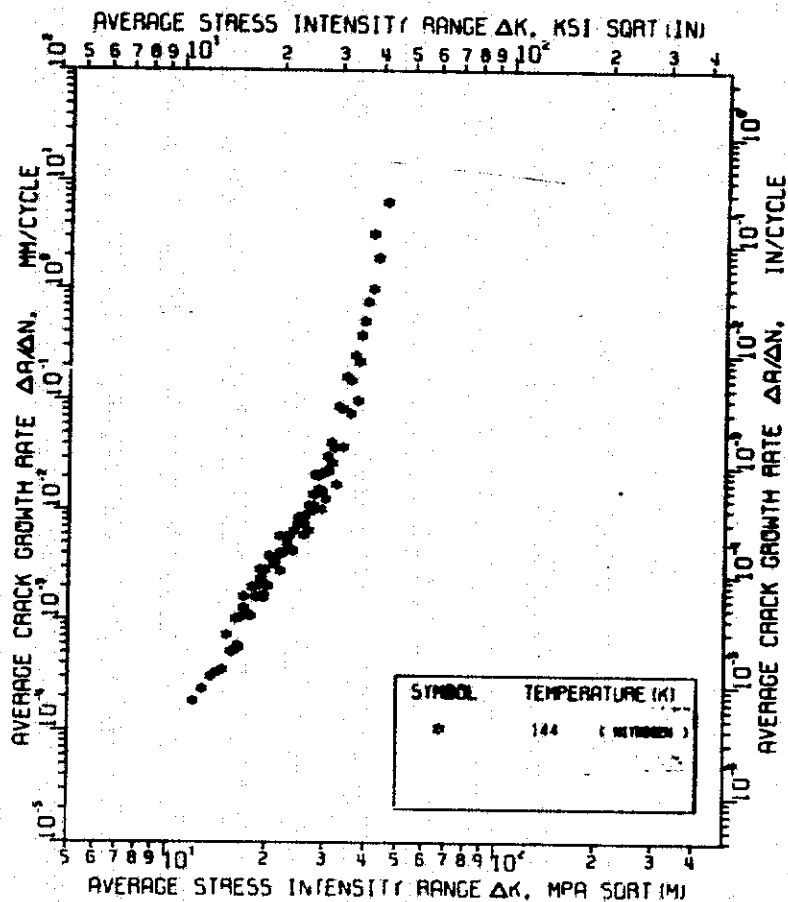
Constraint: Unstiffened

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

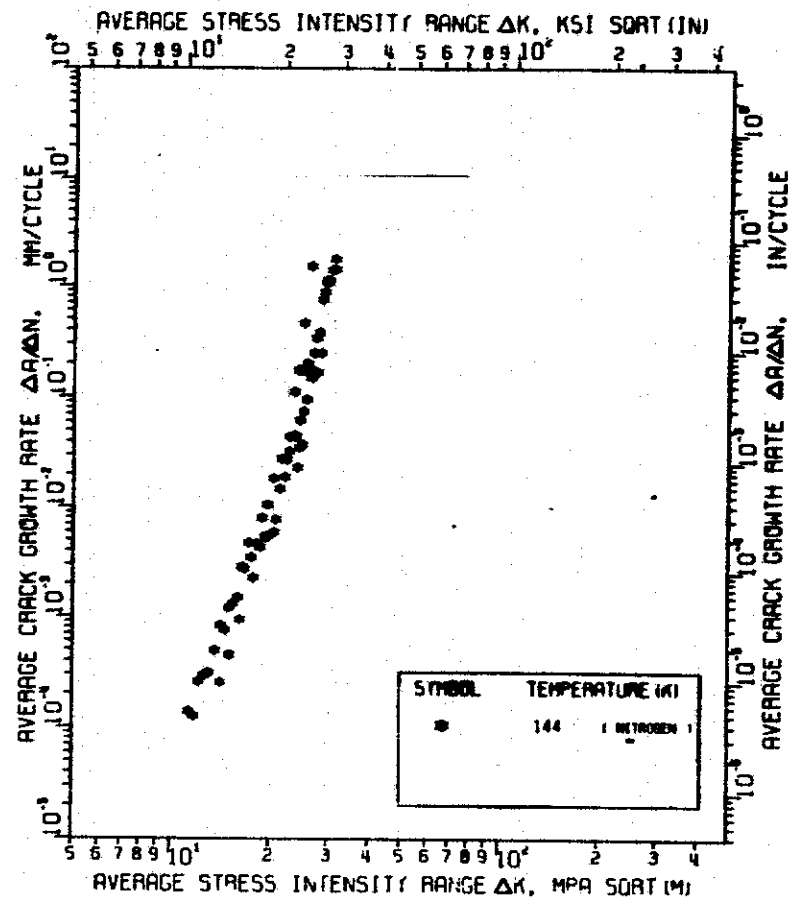
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FIGURE D5-1

(a) Longitudinal



(b) Transverse



Alloy: 2124-T851

Stress Ratio: .50

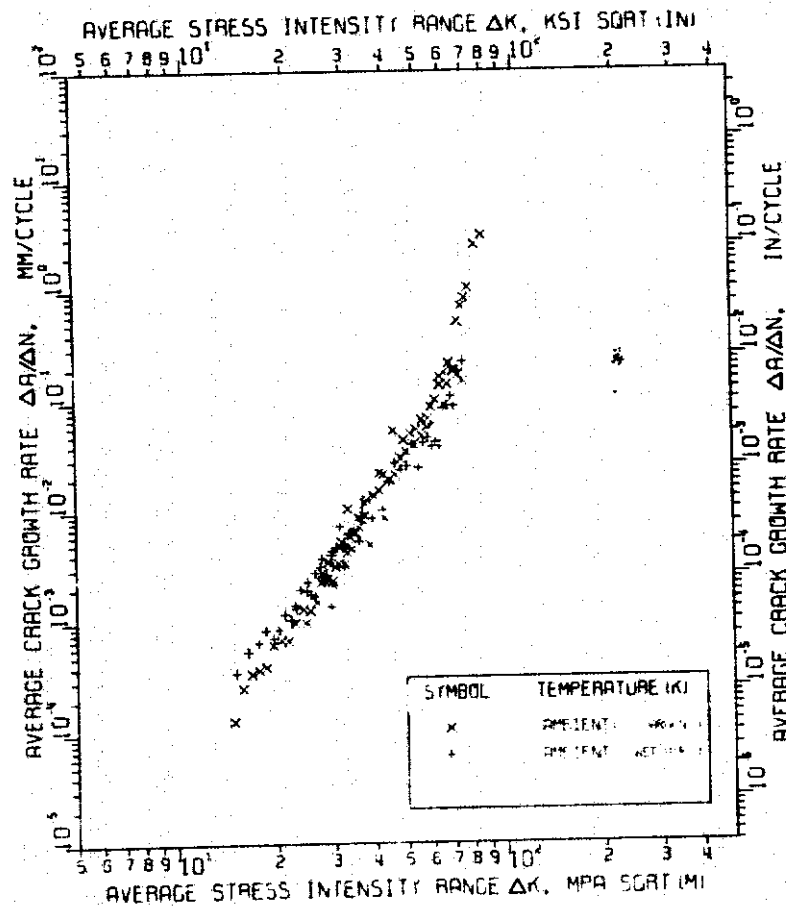
Frequency: 200 cpm

Thickness: 6.35 mm (.250 inch)

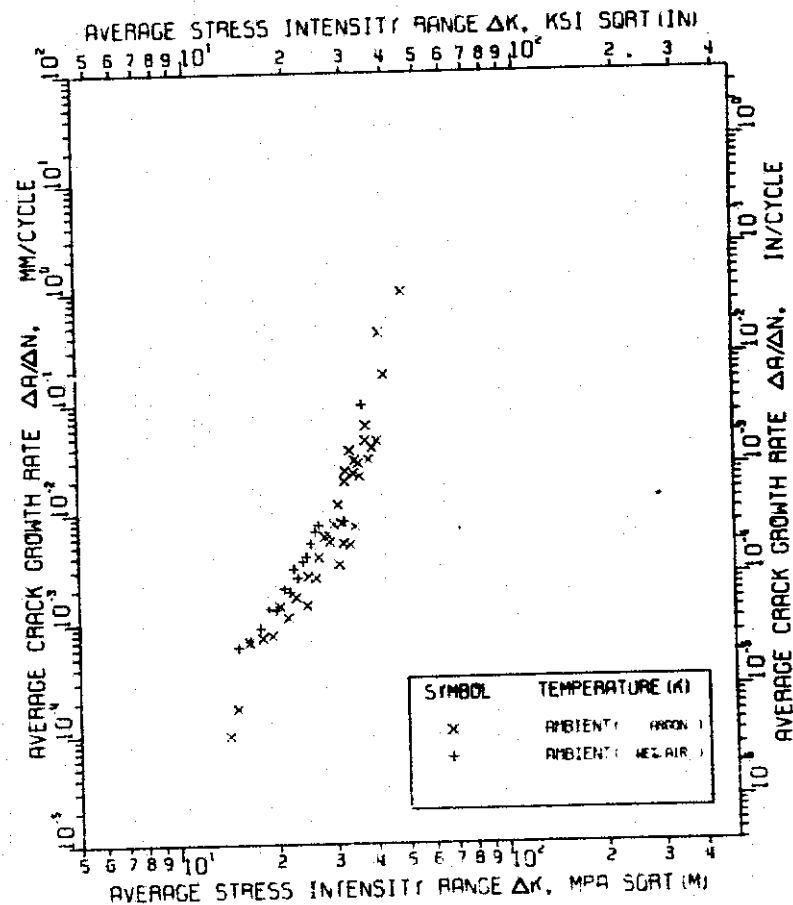
Constraint: Unstiffened

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

(a) Longitudinal



(b) Transverse



Alloy: 2124-T851

Stress Ratio: .05

Frequency: 200 cpm

Thickness: 6.35 mm (.250 inch)

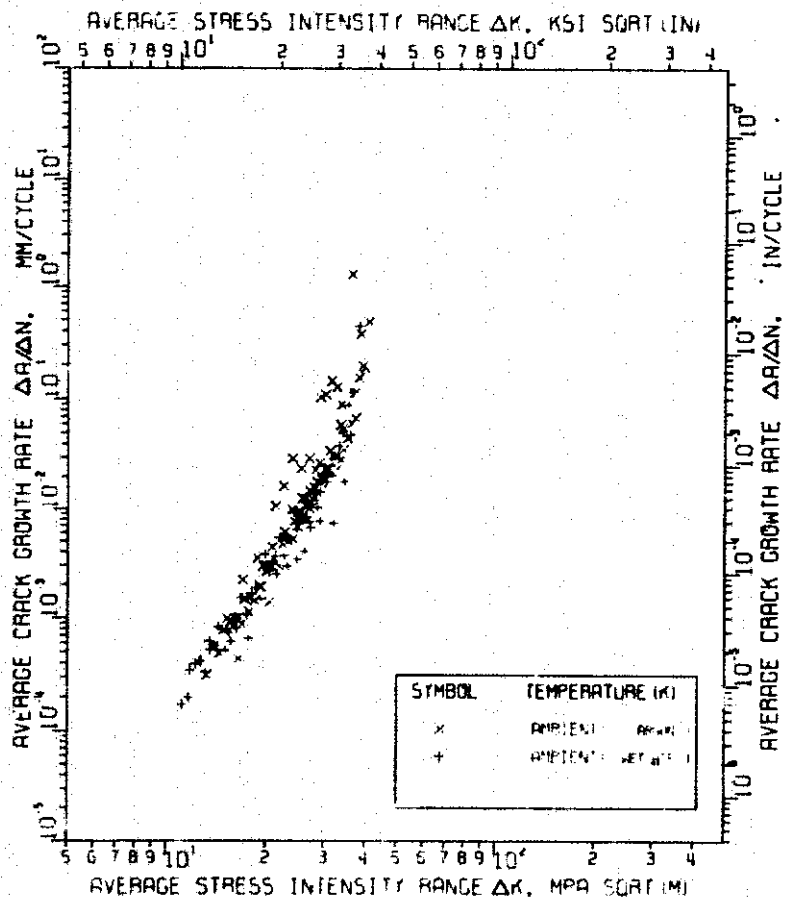
Constraint: Unstiffened

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

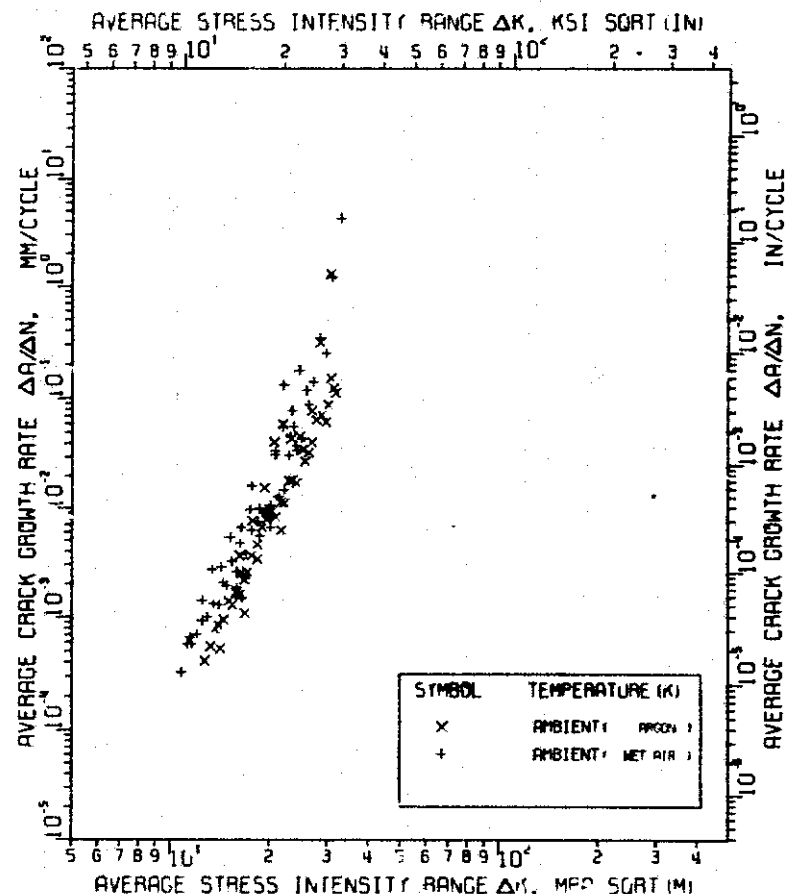
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(a) Longitudinal



(b) Transverse



Alloy: 2124-T851

Stress Ratio: .50

Frequency: 200 cpm

Thickness: 6.35 mm (.250 inch)

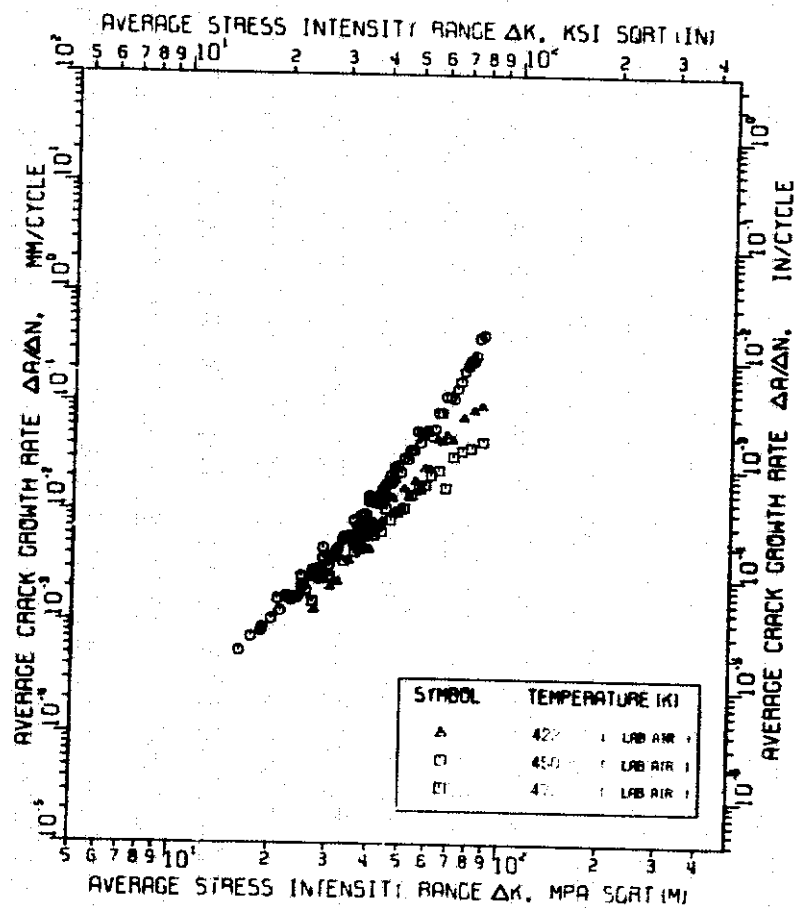
Constraint: Unstiffened

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

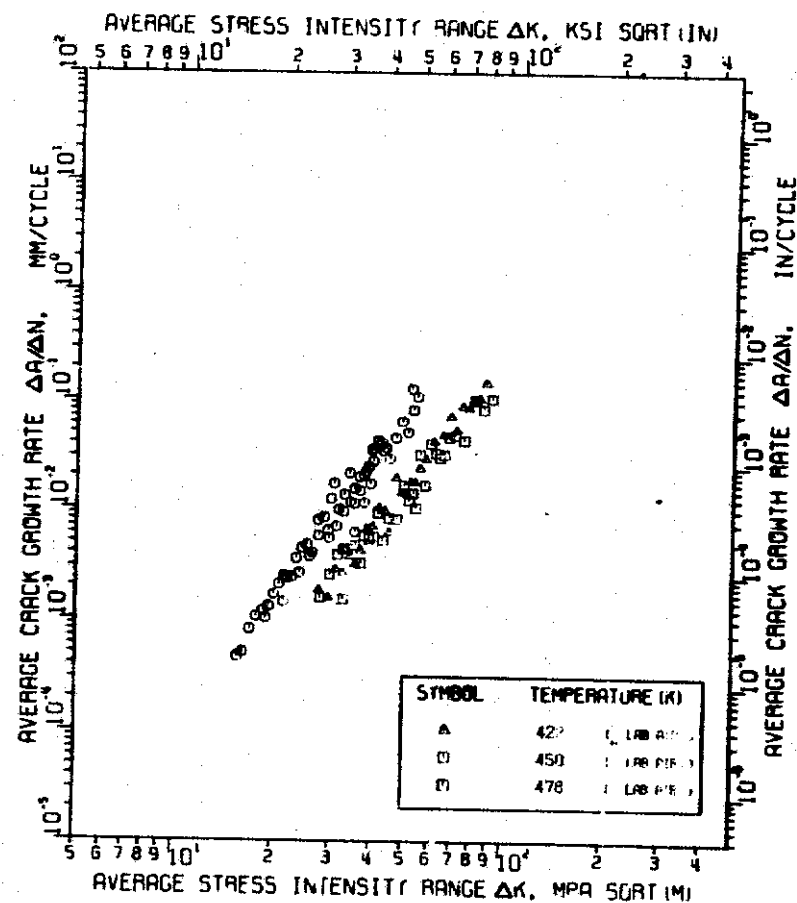
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FIGURE D5-4

(a) Longitudinal



(b) Transverse



Alloy: 2124-T851

Stress Ratio: .05

Frequency: 200 cpm

Thickness: 6.35 mm (.250 inch)

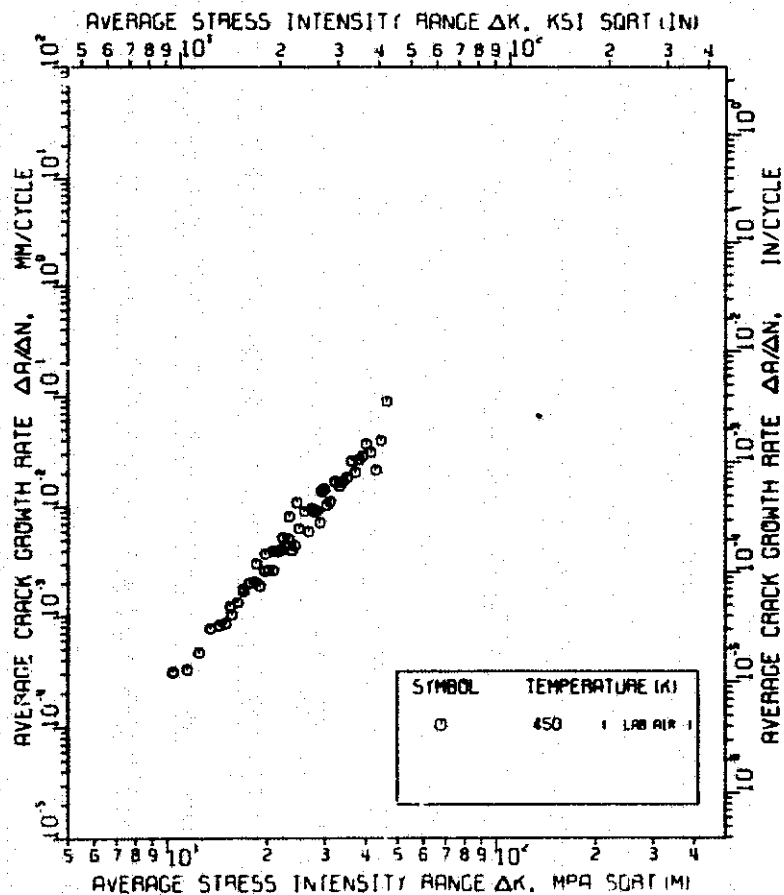
Constraint: Unstiffened

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

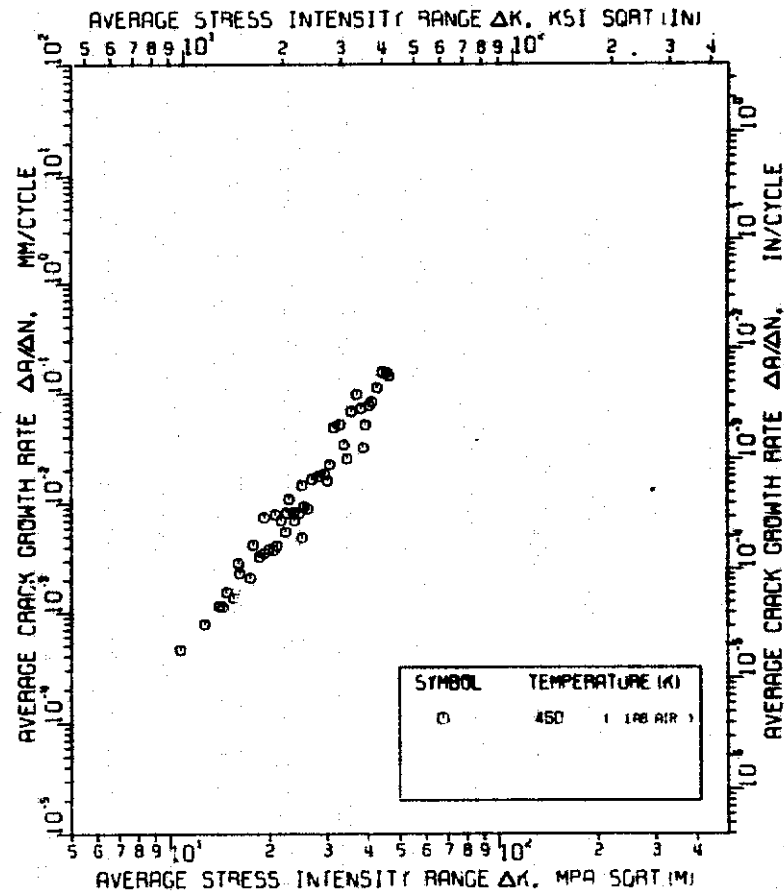
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FIGURE D5-5

(a) Longitudinal



(b) Transverse



Alloy: 2124-T851

Stress Ratio: .50

Frequency: 200 cpm

Thickness: 6.35 mm (.250 inch)

Constraint: Unstiffened

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

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FRACTURE MECHANICS DATA FOR
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SECTION D6 - - FLAW GROWTH RATE DATA
FOR 11.47 mm (.450 INCH) THICK 2124-T851

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FRACTURE MECHANICS DATA FOR
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TABLE D6-1. SUMMARY OF SPECIMEN TEST CONDITIONS FOR 200 CPM TESTS OF
11.47 mm (.450 INCH) THICK 2124-T851.

<u>Test Temperature (°K)</u>	<u>Stress Ratio</u>	<u>Test Direction</u>	<u>Specimen I. D.</u>	<u>Data Table No.</u>	<u>Figure No.</u>
144	.05	L	4L4-456-1	D6-2	D6-1 (a)
			4L4-459-2	D6-3	D6-1 (a)
		T	3T7-456-1	D6-4	D6-1 (b)
			3T6-459-2	D6-5	D6-1 (b)
	.50	L	4L11-456-2	D6-6	D6-2 (a)
			4L3-459-2	D6-7	D6-2 (a)
		T	3T2-456-2	D6-8	D6-2 (b)
			5T4-459-1	D6-9	D6-2 (b)
298 (Argon)	.05	L	4L12-453-1	D6-10	D6-3 (a)
			4L7-456-2	D6-11	D6-3 (a)
			4L7-459-1	D6-12	D6-3 (a)
		T	2T2-453-3	D6-13	D6-3 (b)
			3T1-456-1	D6-14	D6-3 (b)
			1T2-459-1	D6-15	D6-3 (b)
	.50	L	4L9-453-1	D6-16	D6-4 (a)
			5L4-456-2	D6-17	D6-4 (a)
			4L10-459-2	D6-18	D6-4 (a)
		T	1T3-453-1	D6-19	D6-4 (b)
			5T3-456-1	D6-20	D6-4 (b)
			3T2-459-1	D6-21	D6-4 (b)
298 (Wet Air)	.05	L	4L9-453-3	D6-22	D6-3 (a)
			5L6-456-2	D6-23	D6-3 (a)
			5L6-459-1	D6-24	D6-3 (a)
		T	1T3-453-3	D6-25	D6-3 (b)
			1T5-456-2	D6-26	D6-3 (b)
			2T5-459-2	D6-27	D6-3 (b)
	.50	L	5L2-453-1	D6-28	D6-4 (a)
			4L10-456-1	D6-29	D6-4 (a)
			5L4-459-1	D6-30	D6-4 (a)
		T	1T7-453-2	D6-31	D6-4 (b)
			1T2-456-2	D6-32	D6-4 (b)
			3T4-459-2	D6-33	D6-4 (b)

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TABLE D6-1 (Continued)

<u>Test Temperature (°K)</u>	<u>Stress Ratio</u>	<u>Test Direction</u>	<u>Specimen I.D.</u>	<u>Data Table No.</u>	<u>Figure No.</u>
422	.05	L	5L1-453-3	D6-34	D6-5(a)
		T	2T8-453-1	D6-35	D6-5(b)
450	.05	L	5L1-453-2	D6-36	D6-5(a)
			4L8-456-1	D6-37	D6-5(a)
			4L2-459-2	D6-38	D6-5(a)
		T	2T5-456-1	D6-39	D6-5(b)
			2T8-459-2	D6-40	D6-5(b)
			5T3-459-1	D6-41	D6-5(b)
	.50	L	4L2-453-1	D6-42	D6-6(a)
			5L3-456-1	D6-43	D6-6(a)
			4L11-459-1	D6-44	D6-6(a)
		T	1T3-453-2	D6-45	D6-6(b)
			3T4-456-1	D6-46	D6-6(b)
			6T1-459-1	D6-47	D6-6(b)
478	.05	L	4L12-453-2	D6-48	D6-5(a)
		T	2T2-453-1	D6-49	D6-5(b)

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TABLE D6-2

SPECIMEN NUMBER: 416-488-1 ALLOY TYPE: 2024-T861 SPECIMEN ORIENTATION: LONGITUDINAL CONSTRAINT: UNSTIFFENED TEST ENVIRONMENT: NITROGEN TEST TEMPERATURE: 14.52 MM (1.452 IN) SPECIMEN THICKNESS: 21.53 MPa (31.5 KSI) MAXIMUM STRESS: 288 MPa FREQUENCY: 6649 CYCLES CYCLES TO FAILURE: 1 MIN MAX: 1 CYCLES PRIOR TO FAILURE: 74.74 MPa SORT(M) 71.66 KSI SORT(M)						
CRACK LENGTH MM IN	CYCLES	DELTA(S)/DELTA(M) MM/CYCLE IN/CYCLE	DELTA(STRESS INTENSITY) MPa SORT(M) KSI SORT(M)	DELTA(S)/DELTA(M) MM/CYCLE IN/CYCLE	DELTA(STRESS INTENSITY) MPa SORT(M) KSI SORT(M)	DELTA(S)/DELTA(M) MM/CYCLE IN/CYCLE
2.64	.184	.4162E-03	.1638E-04	20.94	19.09	
3.91	.194	.7866E-03	.3697E-04	24.53	22.32	
5.07	.200	.1450E-02	.5789E-04	27.64	25.16	
6.33	.249	.2132E-02	.1154E-03	30.88	28.10	
7.88	.310	.5070E-02	.1996E-03	33.88	30.83	
9.21	.362	.8450E-02	.3523E-03	36.45	33.17	
13.94	.415	.1593E-01	.6270E-03	38.72	35.24	
11.72	.461	.2196E-01	.8645E-03	40.78	37.11	
12.93	.569	.2989E-01	.1177E-02	42.78	38.93	
14.15	.557	.4762E-01	.1875E-02	44.88	40.84	
15.58	.613	.5339E-01	.2132E-02	47.01	42.79	
16.97	.668	.8172E-01	.3218E-02	49.22	44.79	
18.62	.732	.7578E-01	.2983E-02	51.49	46.86	
20.19	.795	.1947E-01	.7664E-02	53.51	48.69	
21.56	.849	.1543E-01	.6063E-02	55.23	50.26	
22.79	.497	.4203E-01	.1655E-01	59.00	53.69	
27.41	1.079	.1273E-01	.5014E-01	64.95	59.11	
32.51	1.280	.1911E-01	.7525E-01	66.39	62.87	
F	36.42	.6447	.4303E-01	72.51	65.99	
F	38.42	1.512				

TABLE D6-3

SPECIMEN NUMBER: 416-489-2 ALLOY TYPE: 2124-T851 SPECIMEN ORIENTATION: LONGITUDINAL CONSTRAINT: UNSTIFFENED TEST ENVIRONMENT: NITROGEN TEST TEMPERATURE: 11.44 MM (1.442 IN) SPECIMEN THICKNESS: 20.13 MPa (29.5 KSI) MAXIMUM STRESS: 220 MPa FREQUENCY: 1785 CYCLES CYCLES TO FAILURE: 1 MIN MAX: 1 CYCLES PRIOR TO FAILURE: 56.54 MPa SORT(M) 74.72 KSI SORT(M)						
CRACK LENGTH MM IN	CYCLES	DELTA(S)/DELTA(M) MM/CYCLE IN/CYCLE	DELTA(STRESS INTENSITY) MPa SORT(M) KSI SORT(M)	DELTA(S)/DELTA(M) MM/CYCLE IN/CYCLE	DELTA(STRESS INTENSITY) MPa SORT(M) KSI SORT(M)	DELTA(S)/DELTA(M) MM/CYCLE IN/CYCLE
2.77	.176	.4843E-03	.3311E-04	27.28	24.82	
3.39	.134	.2164E-02	.8526E-04	30.37	27.68	
4.14	.163	.3895E-02	.1533E-03	33.34	30.34	
4.94	.195	.4781E-02	.1482E-03	35.08	32.45	
5.45	.210	.8721E-02	.3433E-03	37.16	34.03	
5.17	.235	.1209E-01	.5132E-03	38.34	35.98	
6.41	.258	.1931E-01	.7129E-03	41.56	37.41	
7.14	.297	.2125E-01	.8367E-03	42.94	39.08	
7.69	.113	.2775E-01	.9462E-03	44.97	40.77	
9.21	.342	.6514E-01	.2591E-02	47.17	43.11	
9.62	.379	.4017E-01	.1873E-02	49.27	44.79	
10.14	.339	.7170E-01	.3046E-02	51.94	46.35	
11.10	.433	.7770E-01	.3831E-02	53.47	48.66	
12.27	.443	.2144E-01	.8454E-02	56.34	51.31	
13.06	.439	.4741E-02	.3475E-01	61.56	56.22	
17.11	.674	.3163E-01	.1243E-01	74.17	67.34	
28.67	1.147					

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TABLE D6-4

SPECIMEN NUMBER:				377-458-1			
SPECIMEN ORIENTATION:				2124-T851			
CONSTRAINTS:				TRANSVERSE			
TEST TEMPERATURE:				UNSTIFFENED			
SPECIMEN THICKNESS:				NITROGEN			
MAXIMUM STRESS:				11.60 MM (1.459 IN)			
FREQUENCY:				217.2 MPA (31.5 KSI)			
CYCLES TO FAILURE:				288 CPS			
KINAXI 1 CYCLES PRIOR TO FAILURE:				62.51 MPA (9077 IN) 56.49 KSI (8077 IN)			
CRACK LENGTH		CYCLES		DELTA(SI)/DELTA(IN)		DELTA(Stress Intensity)	
MM	IN			MM/CYCLE	IN/CYCLE	MPA SQRT(IN)	KSI SQRT(IN)
2.46	.139	1		.2758E-03	.1786E-04	19.44	14.05
3.22	.127	2032		.6296E-03	.2479E-04	21.61	14.67
3.76	.148	2845		.9188E-03	.3617E-04	23.26	21.17
4.33	.170	3713		.2219E-02	.8694E-04	24.69	22.47
4.78	.198	3710		.2914E-02	.1146E-03	26.27	23.91
5.52	.217	3963		.3174E-01	.1251E-02	28.71	25.49
5.19	.244	3984		.1480E-01	.7403E-03	39.47	26.82
6.77	.297	4116		.2177E+00	.8477E-02	32.64	29.74
9.14	.361	4026		.8143E+01	.3206E+0	48.48	44.12
F	26.43	1.001	4029				

TABLE D6-5

SPECIMEN NUMBER:				376-459-2			
SPECIMEN ORIENTATION:				2124-T861			
CONSTRAINTS:				TRANSVERSE			
TEST TEMPERATURE:				UNSTIFFENED			
SPECIMEN THICKNESS:				NITROGEN			
MAXIMUM STRESS:				11.36 MM (1.459 IN)			
FREQUENCY:				106.2 MPA (15.1 KSI)			
CYCLES TO FAILURE:				288 CPS			
KINAXI 4 CYCLES PRIOR TO FAILURE:				36.46 MPA (5277 IN) 31.36 KSI (5277 IN)			
CRACK LENGTH		CYCLES		DELTA(SI)/DELTA(IN)		DELTA(Stress Intensity)	
MM	IN			MM/CYCLE	IN/CYCLE	MPA SQRT(IN)	KSI SQRT(IN)
4.4	.161	748		.5725E-02	.2254E-03	20.91	17.12

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TABLE D6-6

SPECIMEN NUMBER: 411-456-2
ALLOY TYPE: 2124-T851
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTRESSING
TEST TEMPERATURE: NITROGEN
SPECIMEN THICKNESS: 1.60 IN
MAXIMUM STRESS: 11.51 KSI (79.3 MPa)
FREQUENCY: 200 Hz
CYCLES TO FAILURE: 28150
KINAY: 16 CYCLES PRIOR TO FAILURE: 74.59 MPa SORT(M); 87.88 KSI SORT(M)

CRACK LENGTH IN	IN	CYCLES	DELTA(I)/DELTA(M) MM/CYCLE	DELTA(I)/DELTA(M) IN/CYCLE	DELTA(Stress Intensity) MPa SORT(M)	DELTA(Stress Intensity) KSI SORT(M)
2.65	.124	1	.5845E-04	.2222E-05	10.71	9.74
3.52	.139	15457	.1084E-03	.7416E-05	12.39	11.27
4.74	.196	21896	.4792E-03	.1087E-04	14.19	12.91
6.10	.240	24737	.5383E-03	.3576E-04	15.75	14.33
7.23	.285	25987	.1654E-02	.6512E-04	17.05	15.51
8.18	.330	26172	.3440E-02	.1354E-03	18.50	16.84
9.98	.333	27145	.8346E-02	.3286E-03	19.95	18.15
11.33	.444	27306	.8714E-02	.3431E-03	21.21	19.38
12.71	.510	27455	.1304E-01	.5143E-03	22.47	20.65
14.21	.560	27580	.1388E-01	.5386E-03	23.97	21.45
15.39	.604	27663	.2354E-01	.9045E-03	24.41	22.21
16.11	.642	27710	.2344E-01	.9244E-03	25.92	23.22
18.19	.714	27799	.1620E-01	.6379E-03	26.40	24.47
19.98	.787	27931	.2500E-01	.9075E-03	27.04	25.54
21.60	.844	27961	.4240E-01	.1669E-02	28.15	26.82
23.02	.928	27937	.3214E-01	.1265E-02	30.06	27.36
24.14	.952	28031	.5841E-01	.2221E-02	31.34	28.25
25.93	1.021	28054	.1255E+03	.4147E-02	32.27	29.37
27.31	1.120	28143	.9167E-01	.3699E-02	33.14	31.58
34.99	1.177	28150				

TABLE D6-7

SPECIMEN NUMBER: 413-459-2
ALLOY TYPE: 2124-T851
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTRESSING
TEST TEMPERATURE: NITROGEN
SPECIMEN THICKNESS: 1.60 IN
MAXIMUM STRESS: 11.51 KSI (79.3 MPa)
FREQUENCY: 200 Hz
CYCLES TO FAILURE: 4040
KINAY: 1 CYCLE PRIOR TO FAILURE: 78.77 MPa SORT(M); 71.64 KSI SORT(M)

CRACK LENGTH IN	IN	CYCLES	DELTA(I)/DELTA(M) MM/CYCLE	DELTA(I)/DELTA(M) IN/CYCLE	DELTA(Stress Intensity) MPa SORT(M)	DELTA(Stress Intensity) KSI SORT(M)
2.65	.122	1	.4004E-03	.1578E-04	14.12	12.85
3.29	.179	1470	.6374E-03	.2391E-04	15.67	14.26
4.36	.176	2417	.1312E-02	.5166E-04	17.04	15.50
4.55	.141	3096	.3884E-02	.1522E-03	18.74	16.69
5.71	.219	3485	.7422E-02	.1347E-03	19.76	17.98
F 6.14	.244	3742	.5449E-02	.2350E-03	20.99	19.18
F 6.74	.267	3443	.2915E-01	.1138E-02	22.77	20.73
F 8.47	.314	3900	.2544E-01	.1145E-02	24.79	22.56
F 9.44	.377	3034	.2455E-01	.9667E-03	26.04	23.49
F 11.11	.436	3048	.6545E-01	.2575E-02	27.76	24.90
F 11.42	.457	3948	.7131E-01	.2875E-02	29.70	26.45
F 13.18	.515	4038	.1270E+03	.5000E-02	30.45	27.98
F 14.75	.545	4010	.2159E+03	.8400E-02	32.54	29.63
F 15.51	.612	4028	.1774E+03	.7000E-02	34.18	31.10
F 17.42	.655	4073	.4657E+03	.1833E-01	35.35	32.17
F 18.41	.744	4076	.6688E+03	.2750E-01	36.74	33.44
F 20.19	.718	4034	.2512E+03	.8000E-01	38.48	34.95
F 22.72	.970	4030				

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TABLE D6-8

SPECIMEN NUMBER: 372-456-2			
ALLOY TYPE: 2124-T851			
SPECIMEN ORIENTATION: TRANSVERSE			
CONFINEMENT: UNSTRESS CORROSION			
TEST TEMPERATURE: 140°F			
SPECIMEN THICKNESS: 1.44 IN			
MAXIMUM STRESS: 217.2 MPa (31.4 KSI)			
FREQUENCY: 200 CPS			
CYCLES TO FAILURE: 18478			
K(MAX): 1 CYCLES PRIOR TO FAILURE			
40.63 MPa SORT(M) (36.43 KSI SORT(M))			

CRACK LENGTH	MM	IN	CYCLES	DELTA(S)/DELTA(M)	MM/CYCLE	IN/CYCLE	DELTA(StRESS INTENSITY)	MPa SORT(M)	KSI SORT(M)
2.95	.103		1						
3.10	.125		9851	.1072E-03	.4222E-05			10.31	9.30
3.90	.154		8979	.2306E-03	.9070E-05			11.46	10.43
4.93	.170		10000	.6122E-03	.2410E-04			12.90	11.80
5.13	.190		10193	.2601E-02	.1059E-03			13.32	12.12
6.70	.264		10395	.0249E-02	.3260E-03			14.75	13.42
7.01	.307		10461	.1600E-01	.6644E-03			16.41	14.94
10.75	.423		10477	.1036E+00	.7220E-02			18.50	16.91

TABLE D6-9

SPECIMEN NUMBER				374-456-1
ALLOY TYPE				2124-T851
SPECIMEN ORIENTATION				TRANSVERSE
CONFINEMENT				UNSTRESS CORROSION
TEST TEMPERATURE				140°F
SPECIMEN THICKNESS				1.44 IN
MAXIMUM STRESS				217.1 MPa (31.4 KSI)
FREQUENCY				200 CPS
CYCLES TO FAILURE				2522
K(MAX)				3 CYCLES PRIOR TO FAILURE
				41.61 MPa SORT(M) (37.32 KSI SORT(M))

CRACK LENGTH	MM	IN	CYCLES	DELTA(S)/DELTA(M)	MM/CYCLE	IN/CYCLE	DELTA(StRESS INTENSITY)	MPa SORT(M)	KSI SORT(M)
2.77	.109		1						
3.19	.126		1020	.2332E-03	.9101E-05			13.47	12.25
3.90	.150		2656	.9505E-03	.3766E-04			14.99	13.27
4.22	.166		2473	.2405E-01	.9706E-03			15.62	14.22
6.09	.271		2499	.1029E+00	.4052E-02			18.48	16.75

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TABLE D6-10

SPECIMEN NUMBER: 4112-451-1						
ALLOY TYPE: 2124-T851						
SPECIMEN ORIENTATION: LONGITUDINAL						
CONSTRAINT: UNSTIFFENED						
ENVIRONMENT: ARGON						
TEST TEMPERATURE: 258 K						
SPECIMEN THICKNESS: 11.65 MM (0.459 IN)						
MAXIMUM STRESS: 144.1 MPa (20.9 KSI)						
R-RATIO: 0						
FREQUENCY: 200 CPS						
CYCLES TO FAILURE: 1711 CYCLES						
(MIN) 2 CYCLES PRIOR TO FAILURE: 57.09 MPa SORT(M); 8.31 KSI SORT(M)						
CRACK LENGTH	IN	CYCL	MM/CYCLE	DELTA(A)/DELTA(M)	DELTA(1) DELTA(M)	DELTA(1) DELTA(M)
3.75	.148	1	.2535E-03	.9941E-05	15.40	14.01
4.28	.169	2155	.3749E-03	.1491E-04	16.30	14.80
4.79	.189	3346	.2591E-03	.1174E-04	17.46	15.98
5.27	.203	4717	.4169E-03	.1641E-04	19.97	17.27
5.73	.223	9411	.5159E-03	.2011E-04	21.23	18.61
6.18	.249	11316	.7344E-03	.2494E-04	21.97	19.43
6.63	.263	12672	.1354E-02	.4149E-04	22.79	20.74
7.14	.284	12672	.1124E-02	.4426E-04	23.64	21.53
7.74	.304	12672	.1344E-02	.5291E-04	24.31	22.16
8.28	.325	13012	.1513E-02	.7533E-04	24.78	23.01
8.83	.345	13512	.2226E-02	.1113E-03	26.40	24.03
9.37	.365	13812	.2491E-02	.9805E-04	27.18	24.92
9.91	.385	14146	.2519E-02	.9917E-04	28.16	25.63
10.45	.405	14474	.3472E-02	.1367E-03	28.48	26.27
10.99	.425	14641	.3275E-02	.1289E-03	29.61	26.95
11.53	.445	14844	.4253E-02	.1594E-03	31.60	27.85
12.07	.465	15165	.4492E-02	.1930E-03	31.79	28.93
12.61	.485	15478	.5473E-02	.2312E-03	32.91	29.99
13.15	.505	15717	.7464E-02	.2942E-03	34.15	31.28
13.69	.525	15944	.6372E-02	.2530E-03	35.29	32.11
14.23	.545	16215	.8729E-02	.3437E-03	36.37	33.09
14.77	.565	16126	.1345E-01	.5294E-03	37.47	34.16
15.31	.585	16215	.1202E-01	.4732E-03	38.92	35.25
15.85	.605	16328	.2126E-01	.6370E-03	44.90	40.46

TABLE D6-11

SPECIMEN NUMBER: 417-466-2						
ALLOY TYPE: 2124-T851						
SPECIMEN ORIENTATION: LONGITUDINAL						
CONSTRAINT: UNSTIFFENED						
ENVIRONMENT: ARGON						
TEST TEMPERATURE: 258 K						
SPECIMEN THICKNESS: 13.95 MM (0.551 IN)						
MAXIMUM STRESS: 117.2 MPa (16.9 KSI)						
R-RATIO: 0						
FREQUENCY: 200 CPS						
CYCLES TO FAILURE: 4563 CYCLES						
(MIN) 3 CYCLES PRIOR TO FAILURE: 106.77 MPa SORT(M); 15.36 KSI SORT(M)						
CRACK LENGTH	IN	CYCL	MM/CYCLE	DELTA(A)/DELTA(M)	DELTA(1) DELTA(M)	DELTA(1) DELTA(M)
2.82	.113	1	.8459E-03	.3125E-04	20.48	18.54
3.36	.133	1235	.1447E-02	.5634E-04	23.69	21.46
3.90	.153	1070	.1581E-02	.6232E-04	24.54	22.43
4.44	.173	2741	.3135E-02	.1234E-03	25.41	23.22
4.98	.193	3232	.1344E-02	.1533E-03	26.54	24.62
5.52	.213	3437	.8364E-02	.2129E-03	26.75	25.10
6.06	.233	3744	.7231E-02	.2447E-03	28.17	26.76
6.60	.253	4101	.1144E-01	.5349E-03	41.76	38.17
7.14	.273	4140	.1254E-01	.5197E-03	41.41	38.11
7.68	.293	4217	.2411E-01	.1147E-02	45.13	41.25
8.22	.313	4737	.1213E-01	.4422E-03	46.42	42.59
8.76	.333	4737	.3302E-01	.1300E-02	44.17	44.02
9.30	.353	4737	.3317E-01	.1305E-02	50.77	46.17
9.84	.373	5437	.7547E-01	.2077E-02	54.43	49.53
10.38	.393	6457	.1674E-01	.7788E-02	61.62	56.07
10.92	.413	4435	.7197E-01	.2033E-01	67.47	61.36
11.46	.433	4438	.2735E-01	.1675E-02	74.45	68.24
12.00	.453	4412	.5757E-01	.2267E-02	81.11	72.92

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TABLE D6-12

SPECIMEN NUMBER: 2124-T851 ALLOY TYPE: 2124-T851 TEST TEMPERATURE: 295.0 K SPECIMEN THICKNESS: 11.44 MM (0.45 IN) FREQUENCY: 200 CPS Cycles to Failure: 231 Cycles (MIN) 1 CYCLES PRIOR TO FAILURE 79.65 MPA SORT(M) (71.44 KSI SORT(M))						
CRACK LENGTH	IN	CYCLES	DELTA(A)/DELTA(M)	DELTA(Stress Intensity)	DELTA(Stress Intensity)	DELTA(Stress Intensity)
2.03	.133	1	.1292E-01	.9880E-03	36.40	33.13
3.73	.147	46	.1292E-01	.9880E-03	41.95	38.17
4.71	.145	162	.2226E-01	.1113E-02	48.10	43.77
6.37	.231	221	.5204E-00	.2285E-01	55.31	53.97
F 13.44	.411	129	.1444E-01	.9825E-01	78.75	64.39
F 13.47	.527	210				

TABLE D6-13

SPECIMEN NUMBER: 2124-T851 ALLOY TYPE: 2124-T851 TEST TEMPERATURE: 295.0 K SPECIMEN THICKNESS: 11.44 MM (0.45 IN) FREQUENCY: 200 CPS Cycles to Failure: 1497 Cycles (MIN) 600 CYCLES PRIOR TO FAILURE 34.68 MPA SORT(M) (31.56 KSI SORT(M))						
CRACK LENGTH	IN	CYCLES	DELTA(A)/DELTA(M)	DELTA(Stress Intensity)	DELTA(Stress Intensity)	DELTA(Stress Intensity)
3.87	.141	1	.1578E-03	.6211E-15	14.77	13.37
4.45	.169	1078	.2726E-13	.1673E-14	16.20	14.75
6.24	.216	7638	.4144E-13	.1632E-14	17.97	15.99
6.48	.230	8245	.3474E-13	.1368E-14	18.54	16.88
6.99	.256	11146	.6275E-13	.2475E-14	19.44	17.73
7.14	.241	12158	.6318E-13	.2487E-14	20.29	18.46
7.44	.231	12494	.8748E-13	.3460E-14	21.28	19.37
9.41	.339	14741	.1169E-02	.4603E-14	22.43	20.41
9.48	.371	14794	.9336E-13	.3678E-14	23.34	21.24
11.00	.397	19668	.1733E-02	.6822E-14	24.16	21.99
11.00	.425	19877	.2338E-02	.8024E-14	24.96	22.71
11.48	.452	14911	.2423E-02	.9526E-14	25.53	23.32
11.99	.472	16422	.2309E-02	.9091E-14	26.34	23.97
12.78	.493	16763	.2127E-02	.8373E-14	27.04	24.61
13.31	.524	17612	.3339E-02	.1194E-13	27.94	25.10
13.88	.543	17175	.3478E-12	.1369E-13	28.57	26.00
15.24	.600	17988	.4623E-02	.1820E-13	29.88	27.28
16.47	.648	17855	.3904E-12	.1413E-13	31.08	28.28
17.74	.698	18237	.8732E-12	.3438E-13	32.31	29.40
19.16	.754	18368				

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TABLE D6-14

SPECIMEN NUMBER:		374-456-1	
ALLOY TYPE:		2124-T851	
SPECIMEN ORIENTATION:		TRANSVERSE	
CONSTRAINT:		UNSTIFFENED	
ENVIRONMENT:		ARGON	
TEST TEMPERATURE:		298.0 K	
SPECIMEN THICKNESS:		11.78 MM (0.464 IN)	
MAXIMUM STRESS:		217.2 MPa (31.5 KSI)	
R-RATIO:		0.2	
FREQUENCY:		172.0 CYCLES	
CYCLES TO FAILURE:		172.0 CYCLES	
K1(MAX)		50.64 MPa SQRT(IN) (45.84 KSI SQRT(IN))	
CRACK LENGTH		MM	
IN		CYCLES	
IN/CYCLE		DELTA K1/DELTA IN	
MM/CYCLE		IN/CYCLE	
DELTA STRESS INTENSITY		MPa SQRT(IN)	
KSI SQRT(IN)		KSI SQRT(IN)	
2.55		19.00	
3.72		21.40	
4.31		24.51	
7.74		30.29	
9.77		41.53	
9.11		47.56	
11.11		50.64	
16.64		50.64	

TABLE D6-15

SPECIMEN NUMBER:		172-459-1	
ALLOY TYPE:		2124-T851	
SPECIMEN ORIENTATION:		TRANSVERSE	
CONSTRAINT:		UNSTIFFENED	
ENVIRONMENT:		ARGON	
TEST TEMPERATURE:		298.0 K	
SPECIMEN THICKNESS:		11.64 MM (0.458 IN)	
MAXIMUM STRESS:		172.6 MPa (25.0 KSI)	
R-RATIO:		0.2	
FREQUENCY:		172.0 CYCLES	
CYCLES TO FAILURE:		172.0 CYCLES	
K1(MAX)		33.64 MPa SQRT(IN) (30.61 KSI SQRT(IN))	
CRACK LENGTH		MM	
IN		CYCLES	
IN/CYCLE		DELTA K1/DELTA IN	
MM/CYCLE		IN/CYCLE	
DELTA STRESS INTENSITY		MPa SQRT(IN)	
KSI SQRT(IN)		KSI SQRT(IN)	
2.55		19.00	
3.72		21.40	
4.31		24.51	
7.74		30.29	
9.77		41.53	
9.11		47.56	
11.11		50.64	
16.64		50.64	

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TABLE D6-16

SPECIMEN NUMBER		SPECIMEN ORIENTATION		TEST TECHNIQUE		SPECIMEN TYPE		FREQUENCY		CYCLES TO FAILURE		KINAXI		1 CYCLES PRIOR TO FAILURE		112.66 MPa SQRT(IN)		1102.53 KSI SQRT(IN)	
CRACK LENGTH	IN	CYCLES	MM/CYCLE	DELTA(A)/DELTA(B)	IN/CYCLE	DELTA(Stress)	MPa SQRT(IN)	DELTA(Stress)	KSI SQRT(IN)	DELTA(Stress)	MPa SQRT(IN)	DELTA(Stress)	KSI SQRT(IN)	DELTA(Stress)	MPa SQRT(IN)	DELTA(Stress)	KSI SQRT(IN)	DELTA(Stress)	MPa SQRT(IN)
6.73	.205	6754	.6935E-04	.2731E-05	10.67	9.71													
7.20	.243	14411	.7760E-04	.3655E-05	11.07	10.78													
7.79	.307	10249	.1537E-03	.7627E-05	11.96	10.52													
8.54	.336	20361	.1973E-03	.7481E-05	11.96	10.89													
8.94	.352	23127	.2835E-03	.1116E-04	12.36	11.25													
9.72	.383	25444	.4093E-03	.1611E-04	12.94	11.77													
11.09	.421	26694	.4900E-03	.1929E-04	13.43	12.22													
11.28	.444	27415	.6254E-03	.2462E-04	13.75	12.51													
11.73	.462	28443	.5250E-03	.2667E-04	14.05	12.78													
12.07	.483	29819	.6187E-03	.2436E-04	14.42	13.12													
13.01	.512	30436	.8241E-03	.2457E-04	14.78	13.45													
13.54	.533	31819	.7334E-03	.2769E-04	15.16	13.80													
14.33	.564	32322	.8874E-03	.3415E-04	15.56	14.15													
14.94	.589	33562	.9578E-03	.3770E-04	15.91	14.47													
15.65	.617	33562	.1214E-02	.4779E-04	16.29	14.81													
16.37	.645	34213	.1163E-02	.4645E-04	16.64	15.14													
17.04	.671	34691	.1422E-02	.5597E-04	16.98	15.46													
17.72	.698	35128	.1232E-02	.4852E-04	17.28	15.73													
18.26	.719	35539	.1474E-02	.5813E-04	17.57	15.99													
18.86	.743	35943	.1397E-02	.7473E-04	17.91	16.29													
19.44	.773	36544	.2343E-02	.9226E-04	18.43	16.77													
21.013	.328	37135	.2471E-02	.9725E-04	19.14	17.32													
22.25	.376	37344	.3771E-02	.1495E-03	19.62	17.46													
23.00	.329	37673	.4664E-02	.1828E-03	20.22	18.46													
24.01	.451	37893	.5123E-02	.1977E-03	20.75	18.88													
26.11	1.124	38737	.9703E-02	.3821E-03	22.45	21.40													
F	34.77	39013	.1356E-01	.5341E-03	25.22	22.95													
F	37.57	39115	.1521E-01	.6118E-03	26.12	23.77													
F	39.29	39213	.2173E-01	.8161E-03	26.42	24.41													
F	41.11	39341	.2911E-01	.1146E-02	28.32	25.50													
F	45.29	39341	.3302E-01	.1192E-02	29.11	26.49													
F	46.11	39451	.2927E-01	.1153E-02	29.72	27.15													
F	48.34	3970	.4219E-01	.2448E-02	30.42	27.59													
F	51.14	39727	.5411E-01	.2131E-02	31.74	28.25													
F	51.34	39816	.4169E-01	.1618E-02	31.57	28.73													
F	52.78	39875	.3971E-01	.1564E-02	32.17	29.28													
F	54.33	39814	.5956E-01	.2345E-02	32.44	29.99													
F	56.16	39824	.7366E-01	.2901E-02	33.51	30.49													
F	47.53	39834	.7322E-01	.2745E-02	34.12	31.23													
F	55.42	39834	.6157E-01	.2384E-02	35.14	32.01													
F	61.49	39812	.8927E-01	.3357E-02	36.11	32.77													
F	63.44	39749	.1119E-01	.4365E-02	37.45	34.06													
F	27.94	39814	.2722E-01	.7994E-02	42.55	38.73													
F	44.17	39834	.1471E-01	.5802E-02	47.73	43.43													
F	46.44	39834	.5193E-01	.2115E-02	49.77	45.29													
F	91.73	39834	.9117E-01	.3550E-02	51.75	47.10													
F	92.41	39834	.6451E-02	.2730E-02	52.79	48.13													
F	94.49	39834	.3720E-02	.1441E-02	54.99	49.95													

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TABLE D6-17

SPECIMEN NUMBER: 4110-453-2
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
ENVIRONMENT: AIR
TEST TEMPERATURE: 242.3 K
SPECIMEN THICKNESS: 11.19 MM (0.437 IN)
MAXIMUM STRESS: 141.2 MPa (20.4 KSI)
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 2147
MINIMUM 10 CYCLES PRIOR TO FAILURE: 10

CRACK LENGTH MM	IN	CYCLE S	DELTA(KI)/DELTA(SI) MM/CYCLE	IN/CYCLE	DELTA(KESS) INTERACTIVE MPa (KSI)	KI (KSI)
2.77	.11	577	.1122E-03	.4418E-05	17.92	9.98
3.57	.14	977	.9373E-04	.3634E-06	11.37	10.45
4.11	.16	1577	.1447E-03	.7412E-07	13.31	12.11
5.25	.21	2777	.2536E-03	.1155E-04	14.49	11.55
6.71	.26	3577	.6346E-03	.3287E-04	16.51	15.12
7.97	.31	3777	.6545E-03	.2754E-04	17.78	16.17
9.11	.36	3877	.1678E-02	.6600E-04	18.90	17.20
10.19	.40	2947	.1577E-02	.7732E-04	20.34	19.24
11.17	.44	3077	.7457E-02	.1358E-03	21.07	19.17
12.41	.49	1077	.4619E-02	.1493E-03	22.15	20.16
13.45	.53	1077	.6709E-02	.2444E-03	23.38	21.16
14.3	.56	1747	.1167E-01	.4543E-03	24.14	22.15
16.34	.64	1747	.1464E-01	.5774E-03	25.37	23.19
17.71	.70	2177	.1419E-01	.6374E-03	26.37	24.98
19.11	.75	2177	.1498E-01	.7867E-03	27.67	24.95
20.41	.81	2177	.2591E-01	.1066E-02	28.44	25.90
22.73	.90	2177	.3667E-01	.1440E-02	29.44	26.93
23.57	.93	2133	.6164E-01	.2427E-02	30.74	28.16
26.35	1.03	2133	.5391E-01	.2127E-02	32.50	29.62
28.91	1.12	2141	.6124E-01	.2411E-02	33.77	30.73
30.16	1.19	2141	.6146E-01	.2341E-02	35.11	31.46
32.45	1.27	2141	.1617E-02	.6315E-02	36.56	33.36
35.50	1.39	2133	.1494E-01	.5845E-02	38.17	34.74
37.44	1.47	2133	.1417E-01	.7133E-02	39.41	35.87
39.61	1.56	2125	.2734E-01	.1174E-01	40.64	36.99
41.53	1.63	2133	.4251E-01	.1674E-01	41.37	39.13
47.44	1.85	2146				

TABLE D6-18

SPECIMEN NUMBER: 4110-453-2
ALLOY TYPE: 2124-T851
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTIFFENED
ENVIRONMENT: AIR
TEST TEMPERATURE: 242.3 K
SPECIMEN THICKNESS: 11.19 MM (0.437 IN)
MAXIMUM STRESS: 141.2 MPa (20.4 KSI)
FREQUENCY: 200 CPM
CYCLES TO FAILURE: 2147
MINIMUM 10 CYCLES PRIOR TO FAILURE: 10

CRACK LENGTH MM	IN	CYCLE S	DELTA(KI)/DELTA(SI) MM/CYCLE	IN/CYCLE	DELTA(KESS) INTERACTIVE MPa (KSI)	KI (KSI)
2.74	.11	144	.5210E-03	.2153E-04	17.92	9.98
3.52	.14	144	.1301E-02	.4127E-04	14.49	11.55
4.11	.16	144	.2454E-02	.1141E-03	16.51	15.12
17.77	.70	2144	.1122E-01	.4418E-05	17.92	9.98

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SPECIFIC NUMBER#1 173-453-1
SPECIFIC TYPE#1 172-783-1
SPECIFIC CONSTRAINT#1 UNSTIFFENED
TEST ENVIRONMENT#1 BROWN
SPECIFIC TYPE#2 200 W
FAST PUMP#1 11-4T MM (1.500 IN)
FREQUENCY#1 1400 CPM
CYCLES PRIOR TO FAILURE#1 72.72 MPA SORTIM#1 66.14 MPa

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	CHECK PM	LENGTH IN		DELTA(I)/DELTA(I) IN/CV	DELTA(II)/DELTA(II) IN/CV	DELTA(III)/DELTA(III) IN/CV	STRESS PSI	INTENSITY %I
	6.47	.291	1					
	7.15	.293	48.34	.6440E-04	.2536E-05	12.32		9.40
	7.54	.321	142.07	.8015E-04	.3156E-05	12.70		9.73
	8.37	.325	192.54	.1225E-03	.4941E-05	11.38		10.08
	8.92	.350	228.42	.1492E-03	.7449E-05	11.51		10.44
	9.37	.377	250.60	.2734E-03	.1070E-04	11.97		10.87
	10.27	.404	277.39	.3201E-03	.1260E-04	12.30		11.27
	11.02	.434	291.52	.3881E-03	.1523E-04	12.94		11.68
	11.51	.453	307.43	.3944E-03	.1214E-04	13.21		12.02
	11.97	.468	311.34	.4578E-03	.1802E-04	13.68		12.25
	12.74	.513	324.35	.1240E-02	.4523E-04	14.28		12.49
	13.45	.529	331.17	.1134E-02	.4464E-04	14.64		13.33
	14.13	.536	336.19	.1215E-02	.3997E-04	15.02		13.67
	14.88	.546	343.47	.1563E-02	.7716E-04	15.80		14.02
	15.45	.613	346.55	.1504E-02	.6285E-04	15.74		14.12
	16.14	.637	346.44	.2142E-02	.9221E-04	16.34		14.68
	16.78	.651	353.32	.2112E-02	.7921E-04	16.38		14.91
	17.55	.631	357.24	.7777E-02	.3062E-03	16.74		15.23
	18.24	.714	358.13	.4423E-02	.1439E-03	17.17		15.58
	19.01	.744	360.91	.4717E-02	.1857E-03	17.51		15.94
	19.71	.744	361.55	.3792E-02	.1493E-03	18.63		16.77
F	20.11	.914	370.18	.1120E-01	.4444E-03	19.59		17.83
F	20.15	.994	371.45	.3122E-01	.1370E-02	20.37		18.54
F	21.02	1.105	372.35					
F	24.17	1.115	372.75	.2175E-01	.1750E-02	23.99		19.10
F	31.15	1.135	373.15	.5715E-01	.2250E-02	21.72		19.77
F	32.38	1.275	373.55	.5140E-01	.2600E-02	22.59		20.56
F	33.41	1.335	373.95	.5030E-01	.2600E-02	23.30		21.21
F	35.34	1.415	374.15	.6773E-01	.2667E-02	24.30		21.84
F	37.46	1.475	374.55	.3244E-01	.1230E-02	24.70		22.48
F	41.34	1.594	375.15	.7133E-01	.2875E-02	25.56		23.26
F	42.14	1.705	375.25	.1379E-02	.5000E-02	26.67		24.27
F	44.83	1.765	375.43	.1101E-02	.4333E-02	27.52		25.05
F	46.49	1.810	375.58	.1651E-02	.6500E-02	28.16		25.63
F	49.12	1.938	375.59	.2522E-02	.1111E-01	29.97		26.36
F	51.67	1.935	375.67	.2164E-02	.8121E-02	29.76		27.11
F	52.12	2.111	377.74	.2359E-02	.9246E-02	30.43		27.64
F	53.55	2.111	377.94	.2117E-02	.8333E-02	31.01		27.22
F	55.50	2.145	378.44	.3810E-03	.1580E-01	31.84		28.79
F	57.43	2.265	378.94	.5280E-03	.2000E-01	32.43		29.51
F	59.15	2.325	379.31	.7622E-03	.3000E-01	33.15		30.17
F	62.11	2.445	379.92	.3744E-03	.1200E-01	34.94		31.02
F	64.35	2.535	379.93	.2244E-03	.9000E-01	35.21		32.02
F	65.31	2.535	379.94	.1524E-03	.6000E-01	36.02		32.79

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2024-T861 AND 2124-T851

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TABLE D6-20

SPECIMEN NUMBER: 2124-T851				312-458-1		
ALLOY TYPE: 2124-T851				2124-T851		
SPECIMEN ORIENTATION: TRANSVERSE				TRANSVERSE		
CONSTRAINTS: UNSTIFFENED				UNSTIFFENED		
ENVIRONMENT: ROOM				ROOM		
TEST TEMPERATURE: 23°C				23°C		
SPECIMEN THICKNESS: 11.42 MM (1.443 IN)				11.42 MM (1.443 IN)		
MAXIMUM STRESS: 17.7 MPa (2.56 KSI)				17.7 MPa (2.56 KSI)		
R-RATIO: 0.2				0.2		
FREQUENCY: 2000 CYCLES				2000 CYCLES		
CYCLES TO FAILURE: 45.51 MPa SORTIM (41.42 KSI SORTIM)				45.51 MPa SORTIM (41.42 KSI SORTIM)		
KINAX: 1 CYCLES PRIOR TO FAILURE						
CRACK LENGTH				DELTA (A)/DELTA (H)	DELTA (STRESS INTENSITY)	
MM	IN	CYCLES	MM/CYCLE	IN/CYCLE	MPa SORTIM	KSI SORTIM
2.73	.108	1	.4563E-03	.1796E-04	11.31	12.79
3.49	.153	2545	.4372E-03	.1721E-04	13.31	11.99
5.31	.210	5794	.3784E-02	.1493E-03	14.75	13.42
6.41	.252	8693	.1434E-01	.4722E-03	16.06	14.41
7.48	.295	6197	.1434E-01	.5862E-03	17.41	14.85
8.43	.348	6281	.3129E-01	.1230E-01	20.56	17.71
13.47	.564	6297				

TABLE D6-21

SPECIMEN NUMBER: 2124-T851				312-459-1		
ALLOY TYPE: 2124-T851				2124-T851		
SPECIMEN ORIENTATION: TRANSVERSE				TRANSVERSE		
CONSTRAINTS: UNSTIFFENED				UNSTIFFENED		
ENVIRONMENT: ROOM				ROOM		
TEST TEMPERATURE: 23°C				23°C		
SPECIMEN THICKNESS: 11.32 MM (1.443 IN)				11.32 MM (1.443 IN)		
MAXIMUM STRESS: 32.69 MPa (4.75 KSI)				32.69 MPa (4.75 KSI)		
R-RATIO: 0.2				0.2		
FREQUENCY: 2000 CYCLES				2000 CYCLES		
CYCLES TO FAILURE: 32.69 MPa SORTIM (24.75 KSI SORTIM)				32.69 MPa SORTIM (24.75 KSI SORTIM)		
KINAX: 45 CYCLES PRIOR TO FAILURE						
CRACK LENGTH				DELTA (A)/DELTA (H)	DELTA (STRESS INTENSITY)	
MM	IN	CYCLES	MM/CYCLE	IN/CYCLE	MPa SORTIM	KSI SORTIM
2.13	.084	1	.9886E-02	.1531E-03	15.56	14.16
2.32	.091	50	.3810E-03	.1588E-04	15.92	14.49
2.34	.092	100	.9525E-03	.3796E-04	16.15	14.70
2.45	.097	220				

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2024-T861 AND 2124-T861

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TABLE D6-22

SPECIMEN NUMBER: 4L9-493-3
ALLOY TYPE: 2124-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CORRELATION: UNSUBSTANTIATED
ENVIRONMENT: DRY AIR
TEST TEMPERATURE: 250 F
SPECIMEN THICKNESS: 0.08 IN
FREQUENCY: 117.2 Hz
CYCLES TO FAILURE: 24499
NOMINAL STRESS: 52.81 MPA (50% RY) 41.24 MPA (30% RY)

CRACK LENGTH IN	CYCLES	DELTA K(I)/DELTA K(II)	DELTA K(I)/DELTA K(II)	DELTA K(I)/DELTA K(II)	DELTA K(I)/DELTA K(II)
3.14	123	0.2251E-03	0.8869E-05	11.75	10.70
3.75	7741	0.2722E-03	0.1095E-04	12.92	11.75
4.55	5649	0.3276E-03	0.1290E-04	13.98	12.72
5.18	7737	0.4134E-03	0.1704E-04	14.05	13.52
5.41	8949	0.5103E-03	0.2008E-04	15.77	14.35
6.54	17433	0.5649E-03	0.2224E-04	16.64	15.10
7.34	11674	0.7081E-03	0.2724E-04	17.52	15.94
7.90	12692	0.7673E-03	0.3021E-04	18.62	16.76
9.47	11929	0.8243E-03	0.3261E-04	19.70	17.57
10.7	14745	0.1122E-02	0.4023E-04	20.08	18.27
11.38	15475	0.9445E-03	0.3716E-04	20.80	19.03
11.78	14221	0.1222E-02	0.6211E-04	21.39	19.67
11.80	14617	0.1111E-02	0.4374E-04	22.02	20.84
12.42	17250	0.1462E-02	0.5754E-04	22.40	20.75
13.75	17055	0.1555E-02	0.6185E-04	23.47	21.36
13.91	18254	0.1635E-02	0.6437E-04	23.98	21.82
14.44	18598	0.2190E-02	0.8228E-04	24.44	22.28
15.05	18490	0.2022E-02	0.7961E-04	25.01	22.76
15.71	19199	0.2161E-02	0.8272E-04	25.53	23.23
16.74	19497	0.1646E-02	0.7740E-04	26.35	23.71
17.11	19831	0.2176E-02	0.9393E-04	26.60	24.21
17.73	20140	0.2294E-02	0.1144E-03	27.09	24.65
18.77	20312	0.2761E-02	0.1047E-03	27.54	25.10
19.11	21534				
20.33	21019	0.3105E-02	0.1222E-03	28.34	25.83
21.01	21328	0.3576E-02	0.1404E-03	29.20	26.65
22.67	21661	0.3685E-02	0.1651E-03	30.14	27.43
23.42	21952	0.4337E-02	0.1708E-03	31.33	28.24
25.15	22270	0.5145E-02	0.2027E-03	31.97	29.09
26.45	22459	0.5542E-02	0.2182E-03	32.84	29.94
29.37	22754	0.6972E-02	0.2745E-03	33.79	30.78
29.44	22745	0.1437E-01	0.5643E-03	34.47	31.73
30.46	22939	0.8194E-02	0.3224E-03	35.81	32.59
32.13	23114	0.6195E-02	0.2435E-03	36.55	33.26
33.91	23329	0.9118E-02	0.3590E-03	37.53	34.16
35.49	23459	0.1185E-01	0.4667E-03	38.67	35.19
37.08	23754	0.1397E-01	0.5530E-03	39.67	36.10
39.35	23659	0.1275E-01	0.5000E-03	40.51	36.87
40.13	23729	0.3884E-01	0.1408E-02	41.47	37.74
41.27	23755	0.2208E-01	0.9088E-03	42.38	38.57
42.47	23714	0.2794E-01	0.1188E-02	43.17	39.29
44.23	23854	0.3348E-01	0.1282E-02	44.08	40.12
45.47	23989	0.2940E-01	0.1088E-02	44.95	40.91
46.99	23959	0.3348E-01	0.1200E-02	45.42	41.70
48.28	24034	0.2740E-01	0.1000E-02	46.78	42.50
49.53	24050	0.2540E-01	0.1088E-02	47.45	43.22
51.11	24109	0.3140E-01	0.1408E-02	48.66	44.10
53.74	24156	0.4123E-01	0.1782E-02	49.67	45.20

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FRACTURE MECHANICS DATA FOR
2024-T861 AND 2124-T851

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TABLE D6-23

SPECIMEN NUMBER				SLC-455-2		
ALLOY TYPE				2124-T851		
SPECIMEN ORIENTATION				LONGITUDINAL		
CONSTRAINT				UNSTIFFENED		
ENVIRONMENT				NET AIR		
TEST TEMPERATURE				297.0 K		
SPECIMEN THICKNESS				11.35 MM (0.447 IN)		
MAXIMUM STRESS				217.0 MPA (31.5 KSI)		
R-RATIO				0.20		
FREQUENCY				3700 CYCLES		
CYCLES TO FAILURE				87.00 MPA SORTINI (12.61 KSI SORTINI)		
K(MAX)	2 CYCLES PRIOR TO FAILURE					
CRACK LENGTH MM	IN	CYCLE	DELTA(TAI)/DELTA(TAI) MM/CYCLE	IN/CYCLE	DELTA(STRESS INT.) MPA SORTINI	DELTA(STRESS INT.) KSI SORTINI
2.49	0.098	1	0.914E-03	3.651E-04	27.34	14.51
7.70	0.303	1723	0.1707E-02	6.721E-04	24.13	21.76
9.1	0.357	2031	0.2573E-02	1.016E-03	27.35	24.49
9.17	0.361	2541	0.1775E-02	0.696E-03	15.17	27.45
7.42	0.292	2471	0.5713E-02	0.2245E-03	32.79	15.46
8.43	0.330	3143	0.8749E-02	0.3444E-03	15.75	22.27
9.49	0.373	3127	0.1047E-01	0.4122E-03	37.54	34.17
11.4	0.451	3342	0.1871E-01	0.6185E-03	15.34	16.79
12.66	0.498	3442	0.1617E-01	0.6364E-03	42.24	34.44
13.61	0.533	3712	0.2325E-01	0.9154E-03	43.47	39.42
14.77	0.579	3751	0.3351E-01	0.1555E-02	45.43	41.34
15.41	0.602	3779	0.4331E-01	0.1614E-02	47.19	42.49
16.94	0.666	3814	0.4954E-01	0.1673E-02	48.44	44.70
18.73	0.738	3434	0.5559E-01	0.2101E-02	57.74	45.21
19.42	0.772	3644	0.5437E-01	0.2335E-02	57.71	47.07
21.4	0.849	3744	0.6319E-01	0.2507E-02	54.57	49.42
22.32	0.879	3758	0.8134E-01	0.3158E-02	55.41	51.33
23.43	0.920	3734	0.8712E-01	0.3434E-02	54.27	53.03
25.23	0.993	3743	0.1173E-01	0.4617E-02	60.71	54.78
26.79	1.053	3734	0.1772E-01	0.5494E-02	42.37	56.76
29.77	1.173	3754	0.2581E-01	0.1005E-01	54.44	59.14
31.32	1.233	3774	0.3114E-01	0.3247E-01	55.47	63.19
34.32	1.343	3744	0.1144E-01	0.4417E-01	74.37	67.44
39.44	1.557	3747	0.2744E-01	0.8584E-01	79.41	72.72
46.5	1.813	3741				

TABLE D6-24

SPECIMEN NUMBER				SLC-455-1		
ALLOY TYPE				2124-T851		
SPECIMEN ORIENTATION				LONGITUDINAL		
CONSTRAINT				UNSTIFFENED		
ENVIRONMENT				NET AIR		
TEST TEMPERATURE				297.0 K		
SPECIMEN THICKNESS				11.35 MM (0.447 IN)		
MAXIMUM STRESS				143.0 MPA (20.6 KSI)		
R-RATIO				0.20		
FREQUENCY				3700 CYCLES		
CYCLES TO FAILURE				72.73 MPA SORTINI (10.49 KSI SORTINI)		
K(MAX)	1 CYCLES PRIOR TO FAILURE					
CRACK LENGTH MM	IN	CYCLE	DELTA(TAI)/DELTA(TAI) MM/CYCLE	IN/CYCLE	DELTA(STRESS INT.) MPA SORTINI	DELTA(STRESS INT.) KSI SORTINI
2.49	0.098	1	0.4343E-02	0.1713E-03	12.30	29.40
2.49	0.098	42	0.1524E-02	0.1384E-03	34.17	31.10
2.47	0.117	154	0.5372E-02	0.2117E-03	15.30	32.64
3.23	0.127	713	0.1423E-01	0.5475E-03	34.34	37.43
3.34	0.131	711	0.6472E-02	0.2544E-03	37.43	34.43
3.54	0.139	243	0.1521E-01	0.5994E-03	47.34	36.72
4.70	0.186	245	0.2044E-01	0.8254E-03	43.74	37.36
4.71	0.186	311	0.3312E-01	0.1370E-02	45.44	41.34
6.23	0.244	717	0.4764E-01	0.1477E-02	47.34	41.54
7.76	0.307	334	0.3514E-01	0.1374E-02	57.44	47.10
7.77	0.307	341	0.1314E-01	0.4004E-02	47.70	47.71
7.7	0.307	370	0.1345E-01	0.2124E-02	44.41	44.44
7.34	0.289	371	0.7434E-01	0.1454E-02	47.74	41.44
9.12	0.359	341	0.2244E-01	0.9004E-02	67.44	57.19
9.1	0.359	347	0.3474E-01	0.1447E-01	54.17	57.16
11.41	0.449	347				

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TABLE D6-25[illegible]

	CRACK IN	LENGTH IN	CYCLES	DELTA E (MPA)/ CYCLE	DELTA E (ksi)/ CYCLE	DELTA STRESS MPA (ksi)	INTERVAL DELTA E (ksi)
	3.47	.139	1	.354E-03	.1396E-04	14.19	12.92
	3.49	.153	1394	.6478E-03	.2550E-04	18.52	14.13
	4.41	.196	2437	.7859E-03	.2775E-04	17.36	15.52
	5.70	.224	4075	.1099E-02	.4328E-04	18.31	16.66
	6.02	.253	4713	.9002E-03	.3544E-04	19.17	17.45
	6.47	.277	5724	.1344E-02	.5330E-04	22.95	18.25
	7.65	.311	5811	.1473E-02	.5798E-04	20.98	19.18
	8.74	.325	6212	.1427E-02	.5616E-04	21.71	19.76
	8.76	.347	6777	.1634E-02	.7299E-04	22.58	20.55
	9.62	.379	7014	.1719E-02	.6769E-04	23.49	21.38
	10.27	.404	7414	.2163E-02	.8506E-04	24.32	22.04
	11.15	.427	7685	.2473E-02	.9731E-04	24.87	22.63
	11.47	.449	7924	.2589E-02	.1175E-03	25.57	23.27
	12.14	.476	8142	.2445E-02	.9703E-04	26.24	23.88
	12.66	.498	8351	.3289E-02	.1531E-03	26.97	24.54
	13.46	.530	8571	.3581E-02	.2343E-03	27.77	25.28
	14.15	.559	8795	.9769E-02	.3846E-03	28.43	26.78
F	16.76	.660	8958	.7620E-02	.3058E-03	31.17	28.55
F	18.25	.721	9158	.5715E-02	.2290E-03	32.59	29.66
F	19.43	.765	9354	.8467E-02	.3333E-03	33.66	30.63
F	21.73	.815	9524	.1524E-01	.6000E-03	34.97	31.73
F	22.22	.875	9638	.7620E-02	.3000E-03	35.64	32.61
F	22.95	.935	9738	.1777E-01	.7086E-03	36.53	33.24
F	23.14	.940	9759				
				.3175E-01	.1250E-02	17.61	34.85
F	25.15	.996	9798	.3175E-01	.1250E-02	38.64	36.98
F	26.42	1.046	9878	.3175E-01	.1250E-02	39.65	38.90
F	27.65	1.079	9872	.4657E-01	.1833E-02	40.50	36.86
F	29.08	1.145	9908	.2266E-01	.9080E-03	41.48	37.75
F	31.23	1.190	9958	.8255E-01	.3256E-02	42.55	38.73
F	31.99	1.255	9977	.8893E-01	.3500E-02	43.48	39.91
F	33.65	1.325	9994	.1609E+00	.6333E-02	45.42	41.33
F	36.37	1.421	10013	.1851E+00	.6900E-02	46.93	42.78
F	37.72	1.485	10023	.1905E+00	.7500E-02	48.23	43.90
F	39.62	1.566	10033	.4318E+00	.1700E-01	49.72	45.25
F	41.78	1.645	10038	.5180E+00	.2000E-01	51.44	46.81
F	44.32	1.745	10043	.2204E+03	.9080E-02	52.79	48.04
F	45.67	1.770	10048	.7620E+00	.3000E-01	54.04	49.18
F	47.75	1.886	10051	.6150E+00	.2500E-01	55.58	50.58
F	49.46	1.955	10054	.2794E+01	.8250E-01	57.84	52.84
F	51.45	2.126	10056	.3603E+01	.1900E+00	60.90	55.33
F	57.57	2.295	10057				

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TABLE D6-26

SPECIMEN NUMBER: 275-458-2				11.77 MM (1.468 IN)	
ALLOY TYPE: 2024-T861				217.1 MPA (31.1 KSI)	
SPECIMEN ORIENTATION: TRANSVERSE				200 CPM	
CONSTRAINTS: UNSTIFFENED				2174 CYCLES	
TEST ENVIRONMENT: MCT AIR					
SPECIMEN THICKNESS: 2.37 MM					
SPECIMEN MAXIMUM STRESS: 52.53 MPA SORT(M)				47.80 KSI SORT(M)	
R-RATIO: 1					
CYCLES TO FAILURE: 1					
K(IHAX): 1					
CRACK LENGTH	CYCLES	DELTA(A)/DELTA(N)	DELTA(Stress Intensity)		
MM		MM/CYCLE	IN/CYCLE	MPa SORT(M)	KSI SORT(M)
2.37	1	.5465E-03	.2152E-04	18.67	16.99
2.55	894	.1312E-02	.5164E-04	28.65	14.61
3.41	1310	.2182E-02	.8591E-04	22.32	20.31
4.14	1601	.2322E-02	.9134E-04	23.92	21.77
4.51	1803	.4574E-02	.1002E-03	29.63	23.32
5.31	1977	.8751E-02	.3446E-03	27.45	24.46
5.95	2051	.8482E-02	.3536E-03	28.82	26.23
6.45	2106	.3413E-01	.1344E-02	30.91	29.13
7.91	2146	.1884E-03	.3973E-02	34.41	31.31
9.03	2166	.1158E-01	.4559E-01	41.42	37.70
F 15.62	2171	.2261E-01	.8906E-01	47.68	43.48
F 17.08	2172	.4264E-03	.1600E-01	45.61	45.15
F 18.29	2173				

TABLE D6-27

SPECIMEN NUMBER: 275-459-2				11.65 MM (1.458 IN)	
ALLOY TYPE: 2124-T851				172.9 MPA (25.0 KSI)	
SPECIMEN ORIENTATION: TRANSVERSE				200 CPM	
CONSTRAINTS: UNSTIFFENED				11 CYCLES	
TEST ENVIRONMENT: MCT AIR					
SPECIMEN THICKNESS: 2.37 MM					
SPECIMEN MAXIMUM STRESS: 31.18 MPA SORT(M)				24.34 KSI SORT(M)	
R-RATIO: 1					
CYCLES TO FAILURE: 1					
K(IHAX): 1					
CRACK LENGTH	CYCLES	DELTA(A)/DELTA(N)	DELTA(Stress Intensity)		
MM		MM/CYCLE	IN/CYCLE	MPa SORT(M)	KSI SORT(M)
2.37	1				

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SPECIMEN NUMBER: 512-453-1
SPECIMEN CONDITION: LONELY
CONSTRAINTS: UNSTAYED
TEST RESULTS: 801 PSI
SPECIMEN TYPE: 11.96 MM (4.71 IN)
MANIPULATOR: 103.2 MPA (14.8 KSI)
FREQUENCY: 475 Hz
CYCLES TO FAILURE: 537 CYCLES
K(MAX) 537 CYCLES PRIOR TO FAILURE 62.93 MPA SORTING; 57.27 KSI SORTING

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TABLE D6-29

SPECIMEN NUMBER: 410-496-1				2124-T851	
ALLOY TYPE: LONGITUDINAL				UNSTIFFENED	
SPECIMEN ORIENTATION: 30°				WET AIR	
CONSTRAINT: 11.61 MM (0.457 IN)				3000 N	
ENVIRONMENT: 21.2 MPA (31.5 KSI)				210 APP	
TEST TEMPERATURE: 12466 CYCLES				RT (MI) 85.47 KSI (SPTI MI)	
SPECIMEN THICKNESS: 93.9					
MAXIMUM STRESS: 85.47					
R-RATIO: 1					
FREQUENCY: 1					
CYCLES TO FAILURE: 1					
K(MAX): 1					

CRACK LENGTH IN	CYCLES	DELTA(A)/DELTA(I) MM/CYCLE	IN/CYCLE	DELTA(Stress Intensity) MPA (KSI) MI	DELTA(Stress Intensity) KSI (SPTI) MI
2.69	172	.2254E-11	.8873E-05	10.44	9.86
3.75	146	.5392E-03	.2005E-04	12.72	11.58
4.94	196	.7742E-03	.3.44E-04	14.45	13.15
6.26	247	.1374E-02	.5484E-04	16.00	14.56
7.41	236	.2211E-07	.87.2E-04	17.17	15.41
9.71	343	.3183E-02	.1253E-03	18.57	16.75
9.42	331	.4164E-02	.1641E-03	19.44	18.10
11.29	444	.5254E-02	.2669E-03	21.07	19.14
12.19	484	.1014E-01	.4009E-03	22.00	20.42
13.49	531	.1424E-01	.4033E-03	23.30	20.93
14.73	580	.1941E-01	.6467E-03	24.11	21.94
16.23	619	.1511E-01	.5934E-03	25.17	22.97
17.32	692	.2033E-01	.8036E-03	26.21	24.15
19.7	751	.2415E-01	.9534E-03	27.42	24.55
21.02	812	.2019E-01	.7404E-03	28.36	25.81
21.72	856	.2498E-01	.9830E-03	29.16	26.71
23.47	924	.3103E-01	.1323E-02	30.16	27.62
24.65	971	.3063E-01	.1206E-02	31.77	28.46
26.74	1333	.6274E-01	.2472E-02	32.49	29.75
29.21	1412	.5926E-01	.2294E-02	33.97	30.82
29.91	1478	.1143E-01	.4430E-02	34.56	31.45
31.19	1724	.4384E-01	.1724E-01	35.77	32.55
31.42	1732	.4444E-01	.1757E-01	37.74	33.91
31.5	1749	.6477E-01	.2717E-01	38.16	34.91
37.43	1774	.4411E-01	.1894E-01	38.16	35.91
39.35	1849	.6444E-01	.2551E-01	40.11	37.5
41.45	1851	.1315E-01	.5144E-01	42.77	38.46
44.66	1874	.3244E-01	.1277E-01	45.30	40.45
51.6	2111				

TABLE D6-30

SPECIMEN NUMBER 510-498-1			2124-T851		
ALLOY TYPE: LONGITUDINAL			UNSTIFFENED		
SPECIMEN ORIENTATION: 30°			WET AIR		
CONSTRAINT: 11.61 MM (0.457 IN)			2000 N		
ENVIRONMENT: 21.2 MPA (31.5 KSI)			200 APP		
TEST TEMPERATURE: 77°			CYCLES		
SPECIMEN THICKNESS: 59.67			MPA (SPTI) MI 42.44 KSI (SPTI MI)		
MAXIMUM STRESS: 42.44					
R-RATIO: 1					
FREQUENCY: 1					
CYCLES TO FAILURE: 1					
K(MAX): 1					
4 CYCLES PRIOR TO FAILURE			59.67 MPA (SPTI) MI 42.44 KSI (SPTI MI)		

CRACK LENGTH IN	CYCLES	DELTA(A)/DELTA(I) MM/CYCLE	IN/CYCLE	DELTA(Stress Intensity) MPA (KSI) MI	DELTA(Stress Intensity) KSI (SPTI) MI
2.22	137	.2142E-02	.8435E-04	16.44	15.33
2.77	117	.3175E-02	.1254E-03	17.90	16.37
3.92	115	.4302E-02	.1576E-03	18.32	17.22
4.11	111	.2244E-02	.8452E-04	20.16	18.52
4.49	103	.6454E-02	.2624E-03	21.56	19.62
4.21	105	.1917E-01	.7545E-03	23.35	20.47
5.4	138	.1331E-01	.5241E-02	24.56	22.63
6.71	225	.7464E-01	.2941E-02	26.04	23.70
6.8	239	.6248E-01	.2462E-02	27.13	24.69
6.71	254	.5534E-01	.2177E-02	28.41	25.45
7.31	234				

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TABLE D6-31

SPECIMEN NUMBER: 177-463-7			
ALLOY TYPE: 2124-T851			
SPECIMEN ORIENTATION: TRANSVERSE			
CONSTRAINT: UNSTIFFENED			
TEST ENVIRONMENT: 23.0 K			
TEST TEMPERATURE: 11.44 MM (1.453 IN)			
SPECIMEN THICKNESS: 140.0 MPA (20.3 KSI)			
MAXIMUM STRESS: 200 CPM			
FREQUENCY: 1554 CYCLES			
CYCLES TO FAILURE: 522 CYCLES PRIOR TO FAILURE			
(KINAV) 35.24 MPA SORT(MIN) 34.74 KSI SORT(MIN)			
CRACK LENGTH MM IN	CYCLES	DELTA(KI)/DELTA(IN) MM/CYCLE IN/CYCLE	DELTA(STRESS INTENSITY) MPA SORT(MIN) KSI SORT(MIN)
6.72 .265	1	.34FE-03 .1359E-04	11.4 9.47
7.11 .284	1182	.373FE-03 .1477E-04	11.46 9.95
8.19 .323	4156	.4476E-03 .1762E-04	11.52 11.49
9.1 .355	5869	.5436E-03 .2147E-04	11.96 11.71
9.49 .374	6923	.4172E-03 .3296E-04	12.44 11.32
10.42 .416	7019	.4431E-03 .3319E-04	12.97 11.71
11.32 .444	9111	.4792E-03 .3461E-04	13.14 12.18
11.79 .464	9137	.1354E-02 .5147E-04	13.71 12.54
12.73 .506	10213	.1142E-02 .4131E-04	14.27 12.42
13.25 .522	10737	.1307E-02 .5147E-04	14.54 13.23
13.96 .551	11293	.1391E-02 .5471E-04	14.54 13.54
14.49 .571	11602	.1727E-02 .6742E-04	15.14 13.46
15.14 .592	11979	.1573E-02 .7744E-04	15.40 14.11
15.74 .621	12234	.2543E-02 .1194E-03	16.34 14.42
16.41 .646	12501	.2849E-02 .1137E-03	16.19 14.73
17.11 .671	12835	.1584E-02 .7412E-04	16.49 15.11
17.35 .685	13177	.364E-02 .1449E-03	16.41 15.29
18.37 .723	13773	.4366E-02 .1577E-03	17.21 15.65
19.31 .761	13576	.6541E-02 .2575E-03	17.35 16.33
21.59 .854	13854	.4375E-02 .3297E-03	17.77 17.19
23.31 .916	14024		

TABLE D6-32

SPECIMEN NUMBER: 172-466-2			
ALLOY TYPE: 2124-T851			
SPECIMEN ORIENTATION: TRANSVERSE			
CONSTRAINT: UNSTIFFENED			
TEST ENVIRONMENT: 23.0 K			
TEST TEMPERATURE: 11.11 MM (1.438 IN)			
SPECIMEN THICKNESS: 211.3 MPA (31.1 KSI)			
MAXIMUM STRESS: 200 CPM			
FREQUENCY: 7505 CYCLES			
CYCLES TO FAILURE: 1 CYCLE PRIOR TO FAILURE			
(KINAV) 53.64 MPA SORT(MIN) 41.64 KSI SORT(MIN)			
CRACK LENGTH MM IN	CYCLES	DELTA(KI)/DELTA(IN) MM/CYCLE IN/CYCLE	DELTA(STRESS INTENSITY) MPA SORT(MIN) KSI SORT(MIN)
2.45 .098	1	.2428E-03 .9550E-05	10.64 9.72
3.46 .134	4423	.6917E-03 .2722E-04	12.71 11.57
5.76 .139	4942	.3157E-02 .1243E-03	14.70 13.30
6.59 .255	7324	.9593E-02 .3777E-03	16.53 15.04
9.12 .326	7497	.2559E-01 .1008E-02	18.51 16.84
11.25 .435	7572	.8143E-01 .3222E-01	21.42 19.06
F 15.35 .599	7578	.1549E+00 .6103E-02	24.10 22.01
F 15.38 .629	7593	.1279E+00 .4250E-02	24.67 22.45
F 16.41 .646	7547	.5508E+00 .2200E-01	25.48 23.19
F 18.38 .712	7592	.3348E+00 .1200E-01	26.23 23.87
F 18.39 .724	7591	.1736E+00 .6833E-02	26.56 24.15
F 18.91 .744	7596		

TABLE D6-33

SPECIMEN NUMBER: 374-459-2			
ALLOY TYPE: 2124-T851			
SPECIMEN ORIENTATION: TRANSVERSE			
CONSTRAINT: UNSTIFFENED			
TEST ENVIRONMENT: 23.0 K			
TEST TEMPERATURE: 11.46 MM (1.451 IN)			
SPECIMEN THICKNESS: 172.4 MPA (24.9 KSI)			
MAXIMUM STRESS: 200 CPM			
FREQUENCY: 587 CYCLES			
CYCLES TO FAILURE: 506 CYCLES PRIOR TO FAILURE			
(KINAV) 31.29 MPA SORT(MIN) 24.47 KSI SORT(MIN)			
CRACK LENGTH MM IN	CYCLES	DELTA(KI)/DELTA(IN) MM/CYCLE IN/CYCLE	DELTA(STRESS INTENSITY) MPA SORT(MIN) KSI SORT(MIN)
2.25 .089	1		

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TABLE D6-34

SPECIMEN NUMBER				511-453-3			
SPECIMEN TYPE				LONGITUDINAL			
CONSTRAINT				UNSTRESS			
TEST TEMPERATURE				11.56 MPa (1.688 KSI)			
SPECIMEN THICKNESS				17.5 MPa (2.512 KSI)			
FREQUENCY				200 CPM			
CYCLES TO FAILURE				GRIP FAILURE			

CRACK LENGTH	IN	CYCLES	DELTA(KI)/DELTA(IN)	IN/CYCLE	DELTA STRESS INTENSITY	MPa (KTI)	MPa (KTI)
2.15	.126	1	.3513E-03	.1343E-04	13.44	12.63	
3.95	.156	2163	.6389E-03	.2384E-04	15.24	13.91	
4.71	.186	3436	.6744E-03	.2657E-04	16.54	15.89	
5.47	.216	4596	.6916E-03	.3397E-04	17.71	16.12	
6.14	.242	6321	.6930E-03	.3919E-04	18.70	17.02	
6.81	.268	5995	.1210E-02	.4762E-04	19.75	17.97	
7.43	.300	6667	.1247E-02	.4909E-04	20.76	18.89	
8.11	.337	7214	.1504E-02	.5935E-04	21.59	19.64	
8.92	.351	7616	.2166E-02	.8527E-04	22.15	20.30	
9.41	.374	7914	.1421E-02	.7165E-04	21.70	21.11	
11.27	.404	9370	.2359E-02	.8134E-04	24.10	21.93	
11.18	.415	9711	.2591E-02	.1023E-03	24.76	22.72	
11.47	.466	9982	.2334E-02	.9193E-04	25.64	23.37	
12.48	.441	9272	.2525E-02	.9943E-04	26.44	24.31	
11.71	.375	9619	.3123E-02	.1230E-03	27.74	24.81	
13.14	.507	9017	.3426E-02	.1345E-03	27.91	25.60	
14.67	.575	8036					

TABLE D6-35

SPECIMEN NUMBER		278-453-1	
ALLOY TYPE		2124-T3	
ORIENTATION		TRANSVERSE	
CONSTRAINT		UNSTRESS	
FREQUENCY		200 CPM	
TEST TEMPERATURE		127.0 °C	
*SPECIMEN THICKNESS		11.59 MM (0.456 IN)	
*RATIO		121.7 MPA (17.49 KSI)	
R-RATIO			
FREQUENCY		200 CPM	
CYCLES TO FAILURE		GRIP FAILURE	
CYCLES PRIOR TO FAILURE		24.27 MPA (3.47 KSI) 72.09 KSI (50.71 MPa)	

CRACK LENGTH	IN	CYCLES	DELTA(KI)/DELTA(IN)	IN/CYCLE	DELTA(STRESS INTENSITY)	MPa (KSI)	MPa (KSI)
2.41	.138	1974	.2729E-03	.1075E-04	14.95	13.60	
2.34	.116	3281	.4619E-03	.1817E-04	16.67	14.99	
1.56	.140	3281	.6071E-03	.2392E-04	17.44	16.27	
4.10	.161	4193	.1102E-02	.4339E-04	19.51	17.76	
5.71	.147	5017	.1726E-02	.6794E-04	21.74	19.37	
5.62	.229	5498	.1471E-02	.5792E-04	22.57	20.54	
8.35	.230	5848					

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TABLE D6-36

SPECIMEN NUMBER: 11-403-2
SPECTION ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTRESSING
TEST: TENSILE
SPECIMEN TYPE: TENSILE
MAXIMUM STRESS: 11.43 MPa (1.65 x 10⁶ PSI)
CYCLES TO FAILURE: 30,337
K(MAX) 544 CYCLES PRIOR TO FAILURE: 54.67 MPa (SRTIME) 45.75 KSI (SRTIME)

CRACK LENGTH MM	IN	CYCLES	DELTA K(I)/DELTA S(I) MP/√CYCLE	DELTA K(II)/DELTA S(II) MP/√CYCLE	DELTA STRESS MPa (SRTIME)	DELTA STRESS KSI (SRTIME)
2.97	.117	9932	.1158E-03	.4561E-03	10.87	9.62
3.66	.144	11140	.1349E-03	.6008E-03	11.70	10.65
4.47	.176	13695	.2791E-03	.1099E-04	12.75	11.60
5.17	.204	15391	.3242E-03	.1277E-04	13.95	12.33
5.72	.225	16024	.4203E-03	.1606E-04	14.29	13.00
6.30	.251	18234	.5110E-03	.2012E-04	15.34	13.69
7.33	.277	19415	.5590E-03	.2201E-04	15.78	14.36
7.71	.303	21065	.7847E-03	.3085E-04	16.79	15.20
8.96	.353	22559	.6850E-03	.2697E-04	17.69	16.10
9.55	.376	23143	.9786E-03	.3853E-04	18.79	16.85
10.22	.403	23943	.9834E-03	.3872E-04	18.87	17.17
13.80	.425	24603	.9439E-03	.3714E-04	19.47	17.72
11.55	.455	25120	.9313E-03	.3667E-04	20.36	18.26
12.17	.479	26564	.1274E-02	.4976E-04	20.55	18.70
12.70	.500	26963	.1201E-02	.5043E-04	21.02	19.13
13.24	.523	26963	.1277E-02	.5026E-04	21.54	19.62
14.12	.552	26963	.1238E-02	.4873E-04	22.10	20.11
14.65	.577	26963	.1189E-02	.5467E-04	22.56	20.53
15.20	.598	27360	.1454E-02	.5725E-04	22.99	20.92
15.78	.621	27914	.1758E-02	.6920E-04	23.53	21.41
16.62	.656	28297	.1533E-02	.6037E-04	24.10	21.93
17.33	.642	28976	.1911E-02	.7524E-04	24.57	22.36
17.91	.705		.1582E-02	.6230E-04	24.95	22.74
18.40	.728					
19.22	.756	29421	.1571E-02	.6186E-04	25.44	23.16
19.95	.787	29762	.2309E-02	.9991E-04	25.76	23.63
20.47	.816	30021	.2644E-02	.1042E-03	26.47	24.09
21.37	.841	30340	.2174E-02	.8574E-04	26.94	24.51
22.74	.837	30630	.2524E-02	.9937E-04	27.64	25.15
23.24	.917	31236	.1644E-02	.5407E-04	28.26	25.72
24.75	.956	31494	.3614E-02	.1423E-03	28.76	26.17
26.43	.942	31732	.2557E-02	.1164E-03	29.28	26.65
25.54	1.236	31833	.3145E-02	.1236E-03	29.68	27.01
26.47	1.306	32764	.3454E-02	.1363E-03	30.27	27.55
29.16	1.139	32619	.3781E-02	.1489E-03	31.09	28.29
29.76	1.190	32812	.5692E-02	.2241E-03	31.43	28.96
32.34	1.216	33052	.4184E-02	.1637E-03	32.50	29.57
31.49	1.243	33378	.6037E-02	.1590E-03	33.10	30.21
32.77	1.216	33645	.4481E-02	.1754E-03	33.90	30.81
34.17	1.343	33901	.9249E-02	.2066E-03	34.65	31.53
35.46	1.346	34115	.6189E-02	.2429E-03	35.43	32.24
36.43	1.445	34359	.5689E-02	.2240E-03	36.32	32.96
37.63	1.517	34641	.7677E-02	.3023E-03	37.12	33.76
40.47	1.575	34735	.6638E-02	.2731E-03	38.82	34.60
41.32	1.627	34876	.7199E-02	.2834E-03	38.41	35.32
43.15	1.700	35141	.9171E-02	.3501E-03	39.72	36.14
44.51	1.792	35312	.1103E-01	.3934E-03	40.52	36.97
F 47.55	1.870	35463	.1584E-01	.7828E-03	41.95	38.09
F 48.31	1.910	35501	.1318E-01	.6000E-03	43.01	39.14
F 49.31	1.905	35613	.2794E-01	.1103E-02	43.70	39.77
F 50.30	2.000	35684	.1185E-01	.4667E-03	44.76	40.37
F 51.60	2.035	35743	.1614E-01	.6364E-03	44.98	40.86
F 52.74	2.075	35823	.1270E-01	.5007E-03	45.43	41.36
F 54.14	2.110	36013	.1502E-01	.6111E-03	46.13	41.98
F 55.17	2.180	36069	.2540E-01	.1000E-02	46.92	42.70
F 56.30	2.240	36143	.1805E-01	.7500E-03	47.75	43.45
			.1524E-01	.6000E-03	48.49	44.08

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F	57.4E	7.27E	761.91	.2288E-01	.9000E-03	49.00	44.60
F	58.4E	7.31E	761.41	.2540E-01	.1000E-02	45.74	45.26
F	60.07	7.34E	761.11	.2572E-01	.AC00E-03	50.44	45.90
F	61.4E	7.44E	762.41	.3011E-01	.1500E-02	51.74	46.72
F	62.4E	7.44E	762.11				

TABLE D6-37

SPECIMEN NUMBER:				ALB-484-1			
SPECIMEN ORIENTATION:				LONGITUDINAL			
TEST TEMPERATURE:				UNSTRESSING			
SPECIMEN TYPE:				11.63 MM (1.31 IN)			
MAXIMUM STRESS:				217.1 MPa (31.5 KSI)			
CYCLES TO FAILURE:				3716 CYCLES			
KINAXI 1 CYCLES PRIOR TO FAILURE:				(NET STRESS GREATER THAN 0.9 FTY)			
CRACK LENGTH	IN	CYCLES	DELTA(SI)/DELTA(M)	DELTA(Stress Intensity)	DELTA(Stress Intensity)	DELTA(Stress Intensity)	DELTA(Stress Intensity)
MM			MM/CYCLE	IN/CYCLE	MPa SQR(TIN)	KSI SQR(TIN)	
2.50	.101	1	.9020E-03	.3554E-04	19.88	18.09	
3.33	.131	630	.1473E-02	.5880E-04	22.42	20.40	
4.18	.165	1413	.2190E-02	.8623E-04	24.90	22.66	
5.09	.200	1827	.3361E-02	.1323E-03	26.92	24.58	
5.74	.226	2022	.4253E-02	.1674E-03	28.40	25.85	
6.33	.248	2154	.3806E-02	.1530E-03	30.32	27.32	
7.15	.282	2372	.5278E-02	.2074E-03	31.34	29.06	
8.06	.318	2545	.6131E-02	.2414E-03	33.75	30.72	
8.92	.351	2644	.7514E-02	.2961E-03	35.50	32.30	
9.85	.388	2834	.8357E-02	.3293E-03	37.09	33.76	
10.63	.418	2931	.1322E-01	.4025E-03	39.43	35.88	
12.47	.491	3081	.1325E-01	.5215E-03	41.71	37.96	
13.13	.525	3146	.1622E-01	.6384E-03	43.14	39.26	
14.24	.560	3212	.1384E-01	.5649E-03	44.61	40.60	
15.19	.598	3271	.1898E-01	.7473E-03	45.88	41.75	
15.49	.626	3374	.1961E-01	.7721E-03	47.77	43.02	
17.05	.671	3367	.2009E-01	.7911E-03	48.59	44.31	
17.83	.702	3406	.2647E-01	.1051E-02	45.80	45.32	
19.61	.773	3435	.3271E-01	.1193E-02	50.44	46.36	
19.46	.766	3463	.3550E-01	.1398E-02	52.19	47.41	
20.27	.778	3446	.3749E-01	.1476E-02	51.74	48.49	
21.21	.815	3511	.4621E-01	.1787E-02	54.16	49.47	
21.44	.842	3526	.4664E-01	.1801E-02	55.37	50.35	
22.66	.892	3534	.5370E-01	.1862E-02	57.17	51.96	
F	24.51	.965	.7174E-01	.2820E-02	58.77	53.92	
F	26.16	1.031	.8194E-01	.3271E-02	61.17	56.28	
F	29.71	1.131	.1313E-01	.4211E-02	64.95	59.80	
F	31.73	1.211	.1103E-01	.4727E-02	67.41	61.77	
F	32.49	1.245	.1444E-01	.6051E-02	68.47	63.47	
F	34.43	1.331	.1451E-01	.6531E-02	71.27	66.83	
F	34.71	1.555	.2264E-01	.8464E-02	72.77	69.46	
F	41.68	1.664	.2884E-01	.1111E-01	74.77	73.72	
F	44.41	1.705	.5233E-01	.2743E-01	77.33	75.74	
F	47.31	1.847	.6401E-01	.2744E-01	77.33	75.74	
F	49.05	1.855					
F	50.1	2.014					

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TABLE D6-38

SPECIMEN NUMBER		412-459-7	
ALLOY TYPE		2124-T851	
SPECIMEN ORIENTATION		LONGITUDINAL	
CONSTRAINT		UNSTIFFENED	
ENVIRONMENT		LAB AIR	
TEST TEMPERATURE		65.0 F	
SPECIMEN THICKNESS		11.44 MM (0.45 IN)	
MAXIMUM STRESS		107.0 MPA (15.4 KSI)	
FREQUENCY		730 CP	
CYCLES TO FAILURE		799 CYCLES	
(K MAX)		(NET STRESS GREATER THAN 0.9 FTY)	
1 CYCLE PRIOR TO FAILURE			

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275-456-1
 3124-1451
 TRANS-1451
 UNSTIFF-NEO
 LAS-ATM
 456-0-0
 102.56 MM 1.456
 102.56 MPa 115.0
 200 CPM
 3449 CYCLES
 4.41 KSI 507.17 MPa

60.21 MPa SODIUM CHLORIDE SOLUTION

MCDONNELL DOUGLAS ASTRONAUTICS COMPANY - EAST

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TABLE D6-40

SPECIMEN NUMBER 1						
ALLOY TYPE 1						
SPECIMEN ORIENTATION 1						
CONSTRAINT 1						
ENVIRONMENT 1						
TEST TEMPERATURE 1						
SPECIMEN THICKNESS 1						
MAXIMUM STRESS 1						
R-RATIO 1						
FREQUENCY 1						
CYCLES TO FAILURE 1						
K(MAX) 1 CYCLES PRIOR TO FAILURE 1						
278-459-2						
212-459-1						
TRANSVERSE						
UNSTIFFENED						
148 AS						
60.00 K						
11.45 MM (1.451 IN)						
217.7 MPA (31.5 KSI)						
1891 CYCLES						
223 CPM						
56.63 MPA (8.15 KSI) (63.61 KSI SORTING)						
CRACK LENGTH	IN	MM	DELTA(I)/DELTA(II)	IN/CYCLE	DELTA(II)/DELTA(III)	IN/CYCLE
MM	IN	MM	MM/CYCLE	IN/CYCLE	MPA SORT(II)	INTENSITY(II)
2.46	.237	1	.1197E-02	.4712E-04	19.47	17.66
3.17	.125	592	.1465E-02	.7349E-04	21.49	19.92
4.11	.197	1019	.1315E-02	.1137E-03	24.24	21.88
4.64	.143	1249	.1304E-02	.1421E-03	25.71	23.38
5.22	.216	1411	.1594E-02	.2597E-03	27.47	25.11
6.4	.218	1535	.1117E-01	.4357E-03	29.44	26.79
6.99	.271	1612	.1134E-01	.4464E-03	31.24	28.44
7.48	.312	1641	.1754E-01	.6905E-03	33.23	31.24
8.1	.374	1776	.2655E-01	.1144E-02	35.17	32.00
1.044	.427	1819	.3644E-01	.1436E-02	37.11	33.76
11.33	.453	1821	.5934E-01	.2179E-02	38.77	35.29
12.42	.449	1815	.6595E-01	.2596E-02	40.15	36.74
13.51	.536	1847	.9883E-01	.3892E-02	41.91	38.14
14.59	.574	1858	.8844E-01	.3482E-02	43.65	39.72
15.47	.604	1865	.1275E+00	.5621E-02	45.11	41.05
F	19.38	.724	.3827E+00	.1428E-01	47.35	43.64
F	21.55	.904	.2172E+00	.8551E-02	51.55	46.92
F	22.11	.806	.2921E+00	.1157E-01	54.72	49.16
F	26.66	1.150	.4648E+01	.1832E+00	58.00	52.78
F	28.59	1.126	.1530E+01	.7688E-01	62.39	56.51

TABLE D6-41

SPECIMEN NUMBER 1						
ALLOY TYPE 1						
SPECIMEN ORIENTATION 1						
CONSTRAINT 1						
ENVIRONMENT 1						
TEST TEMPERATURE 1						
SPECIMEN THICKNESS 1						
MAXIMUM STRESS 1						
R-RATIO 1						
FREQUENCY 1						
CYCLES TO FAILURE 1						
K(MAX) 1 CYCLES PRIOR TO FAILURE 1						
278-459-1						
212-459-1						
TRANSVERSE						
UNSTIFFENED						
148 AS						
60.00 K						
11.01 MM (1.447 IN)						
107.5 MPA (15.48 KSI)						
425 CYCLES						
220 CPM						
IN(1) STRESS GREATER THAN 1.9 FTYI						
CRACK LENGTH	IN	MM	DELTA(I)/DELTA(II)	IN/CYCLE	DELTA(II)/DELTA(III)	IN/CYCLE
MM	IN	MM	MM/CYCLE	IN/CYCLE	MPA SORT(II)	INTENSITY(II)
2.89	.134	1	.3575E-02	.1408E-03	28.46	25.91
3.40	.134	212	.7205E-02	.2816E-03	31.17	29.06
4.17	.164	319	.1662E-01	.6542E-03	35.02	31.87
4.97	.196	367	.3954E-01	.1557E-02	38.16	34.73
5.88	.231	398	.4969E-01	.1956E-02	41.06	37.37
6.67	.263	436	.1381E+00	.5433E-02	43.55	39.72
7.50	.295	412	.3562E+00	.1403E-01	46.03	43.71
F	9.64	.380				
F	10.41	.410				
F	11.42	.450				
F	12.60	.496				
IN(1) STRESS GREATER THAN 1.9 FTYI						
IN(1) STRESS GREATER THAN 0.9 FTYI						
IN(1) STRESS GREATER THAN 0.9 FTYI						

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SPECIMEN NUMBER: 612-453-1
ALLOY TYPE: 2024-T861
SPECIMEN ORIENTATION: LONGITUDINAL
CONSTRAINT: UNSTRESS
TEST TEMPERATURE: 150.0 °F
SPECIMEN THICKNESS: 11.43 MM (1.590 IN)
HARDNESS: 104.0 HPA (15.0 KSI)
FREQUENCY: 200 CPS
CYCLES TO FAILURE: 117072
(NET STRESS GREATER THAN 0.5 P105)

CRACK LENGTH PH	IN	CYCLES	DELTA(I)/DELTA(M) PH/CYCLE	IN/CYCLE	DELTA STRESS PFA SORT(M)	INTENSITY KSI SORT(M)
3.31	.130	1	.5523E-04	.2174E-05	6.09	5.54
4.63	.102	23918	.9632E-04	.3792E-05	6.45	6.23
5.42	.213	32113	.4669E-04	.1917E-05	7.24	6.99
5.82	.229	40392	.9789E-04	.3822E-05	7.64	6.95
6.67	.253	49160	.1631E-03	.6422E-05	8.12	7.39
7.44	.293	53886	.1617E-03	.6365E-05	8.51	7.74
8.13	.316	57223	.1502E-03	.5936E-05	8.79	8.08
8.47	.333	60412	.1616E-03	.6361E-05	9.09	8.27
9.17	.361	64767	.1808E-03	.7116E-05	9.19	8.55
9.66	.348	67458	.3705E-03	.1463E-04	9.74	8.86
10.57	.416	69920	.2228E-03	.8773E-05	10.11	9.28
11.22	.442	72838	.2139E-03	.8423E-05	10.39	9.45
11.75	.463	75345	.3673E-04	.1445E-05	10.51	9.58
11.95	.467	77806	.9719E-03	.3826E-04	10.41	9.86
13.01	.512	79499	.3560E-03	.1402E-04	11.21	10.20
13.69	.519	80904	.3639E-03	.1551E-04	11.49	10.45
14.32	.564	82500	.3505E-03	.1380E-04	11.74	10.68
14.44	.598	84157	.4529E-03	.1783E-04	12.00	10.92
15.54	.611	86672	.4404E-03	.1891E-04	12.27	11.17
16.26	.640	87649	.4503E-03	.1773E-04	12.53	11.41
16.92	.656	88647	.4564E-03	.1954E-04	12.78	11.63
17.54	.631	90703	.5752E-03	.2267E-04	13.07	11.85
18.15	.716	90371	.5212E-03	.2052E-04	13.35	12.06
18.74	.719	92054	.6164E-03	.2427E-04	13.64	12.27
19.43	.755	93119	.5567E-03	.2201E-04	13.72	12.48
20.15	.746	94216	.7488E-03	.3026E-04	13.94	12.69
20.71	.815	95172	.6512E-03	.2721E-04	14.18	12.90
21.36	.841	96034	.6339E-03	.2692E-04	14.41	13.11
22.01	.866	96960	.7274E-03	.2865E-04	14.67	13.30
22.59	.896	97747	.9113E-03	.3197E-04	14.84	13.52
23.10	.921	98750	.9530E-03	.3752E-04	15.05	13.74
23.35	.951	99340	.8888E-03	.3420E-04	15.35	13.92
24.39	.937	100000	.8873E-03	.3488E-04	15.61	14.20
24.80	1.018	101523	.9585E-03	.3774E-04	15.91	14.48
25.44	1.040	102046	.1273E-02	.4664E-04	16.12	14.67
26.12	1.074	102704	.1287E-02	.4783E-04	16.47	14.95
26.81	1.114	103337	.1181E-02	.4645E-04	16.40	15.24
27.47	1.111	104047	.1318E-02	.5175E-04	17.00	15.65
28.74	1.111	104812	.1354E-02	.5347E-04	17.61	16.03
29.14	1.200	105440	.1200E-02	.4637E-04	18.33	16.41
30.44	1.110	107611	.1781E-02	.6931E-04	18.60	16.72
31.74	1.107	108363	.1878E-02	.6547E-04	18.67	17.12
32.12	1.117	109124	.2405E-02	.9152E-04	19.70	17.49
32.77	1.147	109848	.1945E-02	.7158E-04	19.56	17.76
33.71	1.154	110524	.2673E-02	.1012E-03	19.85	18.10
34.17	1.151	111144	.2581E-02	.1010E-03	20.11	18.30
35.17	1.151	111751	.2614E-02	.1023E-03	20.77	18.87
36.17	1.151	112417	.3473E-02	.1311E-03	21.17	19.22
37.17	1.174	113080	.3464E-02	.1356E-03	21.54	19.61
38.17	1.174	113740	.3465E-02	.1533E-03	21.33	19.99
39.17	1.174	114400	.1763E-01	.6414E-03	22.34	20.33
40.17	1.174	115060	.1883E-01	.6843E-03	23.17	20.99
41.17	1.174	115720	.1307E-01	.5237E-03	24.37	21.86
42.17	1.174	116380	.4430E-02	.1851E-03	24.76	22.51
43.17	1.174	117040	.4367E-02	.1712E-03	25.53	23.24
44.17	1.174	117700	.4365E-02	.1304E-03	26.15	24.01

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F	61.45	2.427	114912	.5763E-02	.2771E-03	27.15	24.75
F	61.61	2.514	115311	.1954E-01	.6117E-03	28.35	25.53
F	66.41	2.931	115537	.9151E-02	.3603E-03	29.96	26.35
F	66.92	2.713	115766	.1114E-01	.6397E-03	25.64	26.97
F	71.71	2.734	115929	.1477E-01	.5816E-03	30.35	27.62
F	72.49	2.470	116176	.1552E-01	.6111E-03	31.33	28.24
F	74.42	2.931	116176	.1807E-01	.7114E-03	31.93	28.96
F	77.11	3.336	116324	.1991E-01	.7839E-03	32.96	29.99
F	82.27	3.157	116479	.1205E-01	.4746E-03	33.92	31.87
F	81.86	3.223	116617	.3259E-01	.1203E-02	34.72	31.59
F	93.37	3.376	116646	.3349E-01	.1201E-02	35.64	32.44
F	96.11	3.390	116756	.2863E-01	.1127E-02	36.44	33.28
F	97.64	3.452	116811	.3718E-01	.1464E-02	37.66	34.09
F	91.25	3.353	116880	.4623E-01	.1820E-02	39.25	35.72
F	94.87	3.735	116980	.8194E-01	.3226E-02	41.91	38.14
F	99.95	3.935	117042				

TABLE D6-43

SPECIMEN NUMBER: ALLOY TYPE: SPECIMEN ORIENTATION: CONSTRAINT: FAVORABLE: TEST TEMPERATURE: SPECIMEN THICKNESS: MAXIMUM STRESS: R-RATIO: FREQUENCY: CYCLES TO FAILURE: (MIN) 37 CYCLES PRIOR TO FAILURE				513-456-1 2124-T851 LONGITUDINAL UNSTIFFENED LAP JOINT 456.0 K 11.48 MM (1.4520 IN) 217.3 MPa (31.5 KSI) 200 CPM 11061 CYCLES (NET STRESS GREATER THAN 1.9 FTY)			
CRACK LENGTH MM IN	IN	CYCLE	DELTA(S)/DELTA(M) MM/CYCLE IN/CYCLE	DELTA(STRESS INTENSITY) MPA SQR(TIME) KSI SQR(TIME)	DELTA(S)/DELTA(M) MM/CYCLE IN/CYCLE	DELTA(STRESS INTENSITY) MPA SQR(TIME) KSI SQR(TIME)	DELTA(S)/DELTA(M) MM/CYCLE IN/CYCLE
2.65	.104	1	.3182E-03	.1253E-04	10.72	9.76	
1.51	.059	2574	.5271E-03	.2074E-04	12.17	11.12	
4.39	.173	4747	.7377E-03	.2759E-04	13.25	12.16	
9.17	.359	5213	.9826E-03	.3869E-04	14.25	12.97	
5.47	.211	6035	.1314E-02	.5173E-04	15.22	13.45	
5.67	.226	6145	.1211E-02	.4765E-04	16.14	14.00	
7.24	.285	7121	.2504E-02	.7531E-04	16.49	15.37	
4.9	.193	7564	.2311E-02	.8931E-04	17.45	16.25	
3.13	.123	7942	.1769E-02	.6924E-04	18.64	16.96	
3.42	.134	8312	.2335E-02	.9981E-04	19.24	17.53	
1.129	.045	8574	.7614E-02	.9914E-04	19.34	17.15	
11.2	.441	8849	.3315E-02	.1313E-03	21.64	18.74	
11.7	.461	9177	.1973E-02	.1525E-03	21.72	19.11	
12.42	.488	9248	.5591E-02	.2242E-03	21.79	19.83	
12.95	.511	9257	.7741E-02	.2771E-03	22.24	20.28	
13.34	.533	9436	.8812E-02	.3471E-03	22.77	20.73	
14.15	.557	9572	.1167E-01	.4174E-03	23.33	21.23	
14.44	.566	9574	.9521E-02	.3905E-03	23.31	21.76	
15.16	.593	9641	.3018E-02	.3812E-03	24.68	22.46	
16.43	.643	9774	.1344E-01	.5367E-03	25.40	23.12	
17.42	.686	9814	.1334E-01	.4744E-03	25.94	23.52	
17.94	.706	9872	.9831E-02	.3471E-03	26.44	24.18	
18.4	.731	9944	.1135E-01	.4469E-03	27.10	24.92	
2.1	.083	10215					

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	21.77	.447	10175	.1137E-01	.6477E-03	18.14	29.63
	21.71	.443	10238	.1159E-01	.6139E-03	28.56	28.68
	22.44	.445	10259	.2752E-01	.1543E-02	24.34	28.47
	24.44	.342	10243	.2331E-01	.9179E-03	29.96	27.26
F	26.71	1.012	10477	.1344E-01	.5384E-03	31.20	28.48
F	26.41	1.040	10511	.3121E-01	.1231E-02	32.19	29.29
F	28.44	1.124	10559	.2564E-01	.1010E-02	32.37	30.88
F	30.11	1.134	10615	.2545E-01	.1014E-02	33.47	30.78
F	31.74	1.234	10651	.3242E-01	.1274E-02	34.67	31.55
F	32.44	1.246	10697	.3485E-01	.1529E-02	35.64	32.27
F	33.74	1.331	10714	.3591E-01	.1571E-02	36.21	32.96
F	34.34	1.377	10746	.3511E-01	.1382E-02	36.92	33.60
F	36.37	1.432	10794	.3104E-01	.1222E-02	37.71	34.32
F	37.11	1.553	10840	.4744E-01	.1864E-02	38.34	35.56
F	41.44	1.642	10891	.7124E-01	.2483E-02	42.67	37.02
F	43.74	1.724	10926	.5462E-01	.2300E-02	41.74	39.17
F	46.11	1.917	10941	.6151E-01	.2531E-02	43.24	39.38
F	47.24	1.921	10942	.1123E-01	.4421E-02	44.54	40.62
F	57.14	2.771	11010	.3471E-02	.1367E-01	44.13	43.88
F	61.44	2.379	11024				

(NET STRESS GREATER THAN 0.9 FTY)

TABLE D6-44

SPECIMEN NUMBER: 4113-459-1				2124-T851	
ALLOY TYPE: 2124-T851				LONGITUDINAL	
SPECIMEN ORIENTATION: 0				UNSTIFFENED	
CONSTRAINT: 0				LAW AVE	
ENVIRONMENT: 0				LAW B	
TEST TEMPERATURE: 0				LAW C	
SPECIMEN THICKNESS: 0				11.44 MM (0.45 IN)	
MAXIMUM STRESS: 0				177.2 MPA (25.6 KSI)	
R-RATIO: 0				200	
FREQUENCY: 0				200	
CYCLES TO FAILURE: 0				200	
KINAX: 1 CYCLES PRIOR TO FAILURE				200	
				(NET STRESS GREATER THAN 0.9 FTY)	

CRACK LENGTH	IN	CYCLES	DELTA(S) / DELTA(M)	DELTA(STR) INTENSITY		
MM			MM/CYCLE	MPA SORT(M)		
2.71	.107	1	.9621E-03	.3747E-04	15.33	13.67
3.74	.133	712	.2329E-02	.7986E-04	17.67	15.86
4.80	.189	1412	.2177E-02	.8952E-04	19.74	17.96
5.44	.224	1513	.3532E-02	.1391E-03	21.15	19.29
6.16	.254	2011	.5473E-02	.2154E-03	22.26	20.25
6.98	.275	2114	.7341E-02	.2772E-03	23.50	21.38
7.87	.311	2241	.7640E-02	.3004E-03	24.97	22.36
8.35	.329	2314	.9324E-02	.3671E-03	25.50	23.21
9.12	.359	2396				
9.76	.394	2422				
10.47	.417	2471				
F	14.17	.558	2561			
F	15.51	.611	2617			
F	17.51	.689	2659			
F	19.00	.748	2732			
F	20.02	.788	2719			
F	21.93	.864	2763			
F	23.74	.934	2766			
F	25.51	1.105	2786			
F	26.80	1.035	2796			
F	28.17	1.109	2806			
F	29.68	1.169	2816			
F	31.24	1.230	2826			
F	33.32	1.312	2834			
F	35.27	1.386	2837			

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TABLE D6-45

SPECIMEN NUMBERS				173-483-2		
SPECIMEN CRACK TYPE				2124-T851		
CONSTRAINTS				UNSTRESSING		
TEST TEMPERATURE				100°F		
SPECIMEN THICKNESS				11.48 MM (1/2")		
NOMINAL STRESS				100.0 MPa (15.0 KSI)		
FREQUENCY				200 CPS		
CYCLES TO FAILURE				30.27 MPA SORTING 35.74 KSI SORTING		
MINIMUM 2013 CYCLES PRIOR TO FAILURE						
CRACK LENGTH IN	IN	CYCLES	DELTA K (MPa/DELTA IN)	DELTA STRESS MPa SORTING	INTENSITY KSI SORTING	
3.44	.139					
4.12	.158	10232	.5637E-04	.2215E-05	9.99	5.36
4.43	.176	19828	.4301E-04	.1693E-05	8.27	5.71
5.04	.199	29657	.6223E-04	.2449E-05	8.64	6.05
5.67	.223	36815	.9011E-04	.3540E-05	7.07	6.43
6.10	.248	41673	.1269E-03	.4995E-05	7.47	6.80
6.48	.271	46738	.1463E-03	.5759E-05	7.94	7.13
7.45	.295	49889	.1419E-03	.5585E-05	9.19	7.45
8.16	.322	57326	.2 (29E-03)	.7987E-05	8.56	7.79
8.76	.348	55761	.2667E-03	.1047E-04	8.92	8.12
9.38	.365	57356	.1392E-03	.1335E-04	9.23	8.48
9.96	.384	59253	.1240E-03	.1276E-04	9.52	8.86
10.56	.416	60671	.6312E-03	.1580E-04	9.91	9.03
11.16	.441	62113	.4283E-03	.1686E-04	10.09	9.19
11.81	.465	63504	.4511E-03	.1776E-04	10.78	9.45
12.41	.485	64550	.5791E-03	.2290E-04	10.66	9.78
13.11	.512	65596	.5622E-03	.2213E-04	10.97	9.96
13.82	.536	66957	.6530E-03	.1783E-04	11.19	10.18
14.49	.558	67816	.5505E-03	.2326E-04	11.44	10.41
14.97	.586	68882	.7047E-03	.2774E-04	11.70	10.64
15.48	.614	69703	.7513E-03	.2960E-04	11.96	10.89
16.17	.633	70633	.6477E-03	.2555E-04	12.20	11.10
16.65	.657	71565	.6495E-03	.2557E-04	12.44	11.32
17.13	.692	72782	.9665E-03	.3806E-04	12.68	11.54
17.47	.715	72516	.8337E-03	.3280E-04	12.72	11.75
18.49	.728	73157	.9384E-03	.3577E-04	13.13	11.95
19.19	.752	74044	.1231E-02	.4447E-04	13.16	12.15
19.86	.774	74775	.1084E-02	.4269E-04	13.57	12.35
21.13	.811	75253	.1192E-02	.5481E-04	13.81	12.56
21.55	.833	75510	.1104E-02	.7101E-04	14.36	12.80
21.79	.878	75652	.1394E-02	.5687E-04	14.32	13.03
22.17	.881	76357	.1501E-02	.5911E-04	14.91	13.23
23.38	.915	76791	.1572E-02	.7745E-04	14.78	13.45
23.87	.941	78120	.1534E-02	.7614E-04	15.34	13.69
24.05	.946	77492	.1833E-02	.7218E-04	15.26	13.89
25.17	.941	77539	.1381E-02	.5637E-04	15.44	14.09
25.44	1.014	78318	.1404E-02	.7118E-04	15.69	14.28
26.73	1.052	79756	.2110E-02	.7947E-04	15.95	14.52
27.47	1.077	79091	.2121E-02	.8352E-04	16.78	14.82
28.75	1.140	79732	.2451E-02	.9649E-04	16.64	15.14
30.71	1.136	81104	.3524E-02	.1627E-03	17.03	15.49
31.59	1.263	80492	.3177E-02	.1328E-03	17.44	15.97
32.95	1.234	80432	.4021E-02	.1596E-03	17.96	16.25
34.77	1.368	81122	.4700E-02	.1693E-03	18.77	16.62
37.42	1.348	81428	.4152E-02	.1490E-03	19.65	16.98
38.76	1.442	81615	.5039E-02	.2297E-03	19.32	17.31
41.11	1.511	81669	.5905E-02	.2325E-03	19.61	17.66

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TABLE D6-46

SPECIMEN NUMBER				314-456-1				
SLOT TYPE				312-456-1				
SPECIMEN ORIENTATION				TRANSVERSE				
CONSTRAINTS				UNSTIFFENED				
ENVIRONMENT				LAB AIR				
TEST TEMPERATURE				453.0 K				
SPECIMEN THICKNESS				11.39 MM (0.448 IN)				
MAXIMUM STRESS				217.1 MPA (31.5 KSI)				
FREQUENCY				200 CPM				
CYCLES TO FAILURE				5730 CYCLES				
1 CYCLES PRIOR TO FAILURE				32.34 MPA SORTIMIN R2.21 KSI SORTIMIN				
CRACK LENGTH	MM	IN	CYCLES	DELTA(KI)/DELTA(N)	MM/CYCLE	IN/CYCLE	DELTA(Stress Intensity)	
							MPa (TMIN)	KSI (TMIN)
7.93	.312		1	.335E-03	.130E-04	10.95	9.97	
1.56	.140		1914	.135E-02	.532E-04	12.46	11.34	
4.43	.191		2496	.831E-03	.327E-04	13.74	12.52	
5.41	.213		3536	.251E-02	.1031E-03	14.64	13.36	
9.74	.246		3857	.290E-02	.114E-03	15.72	14.31	
7.11	.281		4103	.291E-02	.115E-03	16.95	15.56	
7.47	.312		4307	.644E-02	.249E-03	17.25	15.74	
3.37	.331		4639	.111E-02	.1147E-03	17.43	16.23	
8.75	.345		4747	.101E-01	.417E-03	14.33	14.68	
9.33	.347		4741	.277E-02	.817E-04	15.75	17.06	
9.01	.378		4771	.741E-02	.274E-03	19.21	17.48	
11.25	.424		4803	.190E-01	.742E-03	20.25	18.43	
11.78	.444		4944	.124E-01	.492E-03	21.47	19.54	
13.96	.517		5134	.111E-01	.434E-03	22.20	21.79	
13.07	.538		5112	.149E-01	.606E-03	23.27	22.35	
14.07	.578		5101	.178E-01	.701E-03	23.44	21.74	
15.79	.622		5224	.373E-01	.127E-02	24.60	22.41	
16.04	.651		5247	.174E-01	.705E-03	25.75	23.17	
17.07	.681		5311	.370E-01	.129E-02	26.21	23.85	
18.02	.741		5345	.237E-01	.803E-03	26.32	24.58	
19.44	.771		5373	.361E-01	.149E-02	27.45	25.16	
F 20.44	.821		5414	.245E-01	.112E-02	28.57	26.44	
F 21.91	.869		5404	.292E-01	.115E-02	29.71	27.57	
F 22.46	.901		5444	.334E-01	.131E-02	30.84	27.16	
F 23.40	.939		5514	.449E-01	.194E-02	30.84	27.32	
F 24.14	.934		5544	.474E-01	.184E-02	31.87	28.80	
F 26.41	1.055		5574	.542E-01	.217E-02	32.44	29.56	
F 27.14	1.034		5604	.745E-01	.293E-02	33.15	30.20	
F 28.02	1.112		5619	.779E-01	.3.07E-02	33.41	31.96	
F 31.19	1.194		5674	.711E-01	.280E-02	34.57	31.40	
F 31.37	1.217		5614	.113E-01	.445E-02	35.75	32.18	
F 31.11	1.293		5604	.444E-01	.212E-02	36.19	32.43	
F 31.31	1.330		5604	.454E-01	.217E-02	37.18	33.44	
F 33.45	1.411		5614	.454E-01	.217E-02	37.18	33.44	
F 34.13	1.409		5614	.247E-01	.475E-02	38.51	35.05	
F 34.99	1.571		5714	.154E-01	.655E-02	39.74	36.14	
F 42.17	1.664		5724	.237E-01	.935E-02	40.17	37.78	
F 41.22	1.714		5724	.170E-01	.670E-02	41.43	38.16	
F 44.35	1.746		5714	.184E-01	.741E-02	42.10	38.70	
F 46.41	1.837		5714	.654E-01	.270E-01	43.44	39.16	
F 47.07	1.841		5714	.217E-01	.817E-02	44.35	40.55	
F 49.25	1.846		5714	.917E-01	.355E-01	44.47	40.44	

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TABLE D6-47

SPECIMEN NUMBER: 671-459-1			ALLOY TYPE: 2124-T851		
SPECIMEN ORIENTATION: TRANSVERSE			CONSTRAINTS: UNSTIFFENED		
TEST TEMPERATURE: LAB AIR			SPECIMEN THICKNESS: 1.0 IN		
MAXIMUM STRESS: 11.43 MPa (1.655 ksi)			FREQUENCY: 200 CPS		
CYCLES TO FAILURE: 1309 CYCLES			NET STRESS GREATER THAN 0.9 FTY		
(MAX) 1 CYCLE PRIOR TO FAILURE					
CRACK LENGTH MM IN	CYCLES	DELTA(S1)/DELTA(S2) MM/CYCLE IN/CYCLE	DELTA(STRESS INTENSITY) MPa SQRT(IN) KSI SQRT(IN)		
2.12 .332	1	.1093E-02	.6374E-04	14.17	12.90
3.14 .122	715	.4371E-02	.1603E-03	15.91	14.40
3.73 .147	861	.5070E-02	.1996E-03	17.30	15.75
4.14 .171	942	.1070E-01	.4211E-03	15.25	17.51
5.54 .222	1103	.2391E-01	.9419E-03	21.13	19.22
6.18 .251	1134	.3524E-01	.1387E-02	22.50	20.57
7.16 .290	1162	.2744E-01	.1098E-02	23.97	21.72
F 7.94 .313	1193	.1224E-01	.4633E-03	24.50	22.39
F 8.12 .328	1213	.2542E-01	.1000E-02	25.24	22.99
F 8.43 .346	1231	(NET STRESS GREATER THAN 0.9 FTY)			
F 10.22 .402	1253	(NET STRESS GREATER THAN 0.9 FTY)			
F 10.97 .421	1273	(NET STRESS GREATER THAN 0.9 FTY)			
F 11.49 .468	1283	(NET STRESS GREATER THAN 0.9 FTY)			
F 13.75 .541	1293	(NET STRESS GREATER THAN 0.9 FTY)			
F 14.30 .563	1298	(NET STRESS GREATER THAN 0.9 FTY)			
F 15.99 .630	1323	(NET STRESS GREATER THAN 0.9 FTY)			
F 16.57 .652	1335	(NET STRESS GREATER THAN 0.9 FTY)			
F 17.96 .707	1337	(NET STRESS GREATER THAN 0.9 FTY)			
F 19.60 .771	1348	(NET STRESS GREATER THAN 0.9 FTY)			

TABLE D6-48

SPECIMEN NUMBER: 4112-451-2			ALLOY TYPE: 2124-T851		
SPECIMEN ORIENTATION: LONGITUDINAL			CONSTRAINTS: UNSTIFFENED		
TEST TEMPERATURE: LAB AIR			SPECIMEN THICKNESS: 1.0 IN		
MAXIMUM STRESS: 11.43 MPa (1.655 ksi)			FREQUENCY: 200 CPS		
CYCLES TO FAILURE: 4673 CYCLES			NET STRESS GREATER THAN 0.9 FTY		
(MAX) 1 CYCLE PRIOR TO FAILURE					
CRACK LENGTH MM IN	CYCLES	DELTA(S1)/DELTA(S2) MM/CYCLE IN/CYCLE	DELTA(STRESS INTENSITY) MPa SQRT(IN) KSI SQRT(IN)		
6.83 .269	1	.6849E-03	.2697E-04	19.95	17.79
7.32 .288	713	.8021E-03	.3150E-04	20.19	18.37
7.76 .306	1264	.1294E-02	.5094E-04	21.07	19.10
8.66 .341	1958	.1356E-02	.5337E-04	22.00	20.02
9.22 .363	2373	.1713E-02	.6745E-04	22.76	20.71
9.91 .390	2777	.1566E-02	.6165E-04	23.47	21.36
10.42 .410	3099	.2144E-02	.8439E-04	24.19	22.01
11.16 .439	3445	.2087E-02	.8216E-04	25.00	22.75
11.47 .468	3767	.2526E-02	.9945E-04	26.14	23.78
13.26 .522	4336	.3103E-02	.1221E-03	27.25	24.80
14.13 .552	4583	.2923E-02	.1151E-03	28.12	25.59
14.99 .590	4911	.3024E-02	.1191E-03	28.99	26.29
15.60 .614	5113	.4283E-02	.1696E-03	29.65	26.98
16.57 .652	5341	.3240E-02	.1276E-03	30.32	27.59
17.11 .670	5477	.3117E-02	.1227E-03	30.76	27.99
17.52 .690	5640	.7710E-02	.3035E-03	31.34	28.52
18.29 .720	5739	.4499E-02	.1771E-03	31.94	29.07
18.47 .743	5863	.7473E-02	.2944E-03	32.64	29.71
19.47 .782	6022	.7656E-02	.3014E-03	33.31	30.32
20.40 .813	6072	.7325E-02	.2766E-03	33.94	30.79
21.43 .830	6144	.6694E-02	.2243E-03	34.45	31.35
21.74 .841	6332	.6422E-02	.2686E-03	35.07	31.91
22.56 .848	6437	.1071E-01	.4214E-03	35.82	32.60
23.66 .932	6513	.6351E-02	.2347E-03	36.50	33.22
24.23 .954	6644	.7421E-02	.2961E-03	37.17	33.78
25.16 .992	6732				

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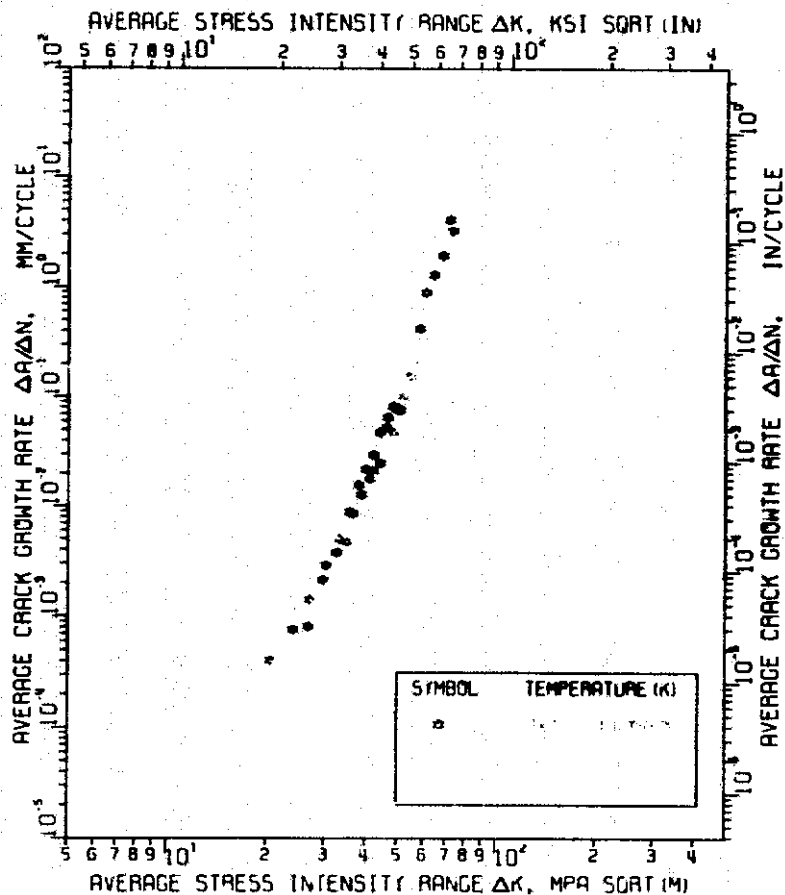
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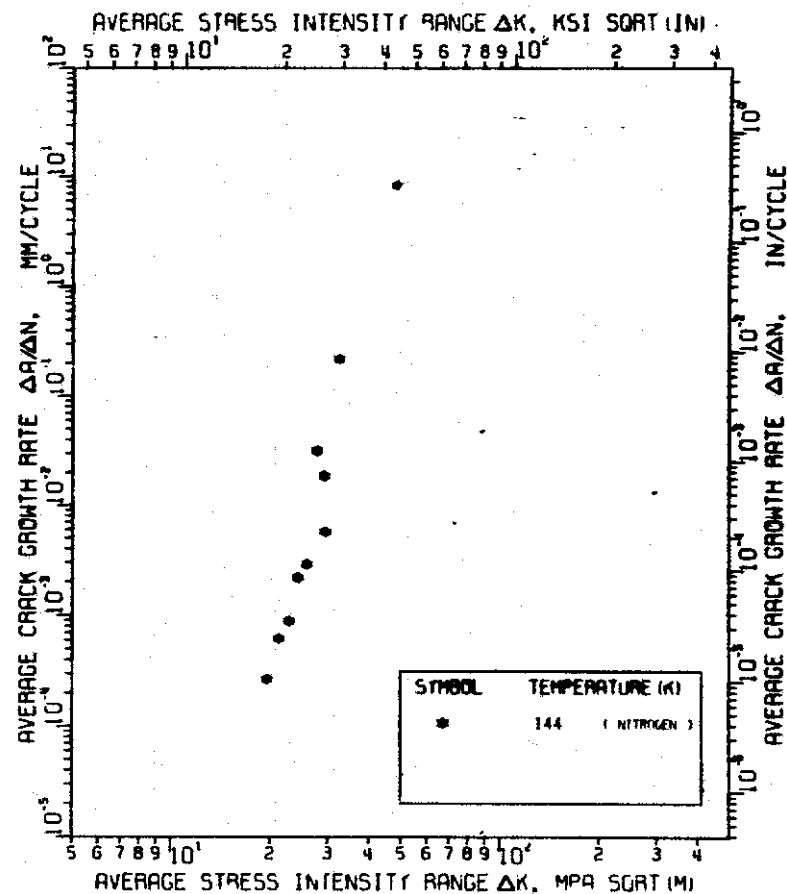
TABLE D6-49

SPECIMEN NUMBER: ALLOY TYPE: SPECIMEN ORIENTATION: CONSTRAINT: ENVIRONMENT: TEST TEMPERATURE: SPECIMEN THICKNESS: MAXIMUM STRESS: R-RATIO: FREQUENCY: CYCLES TO FAILURE: K(MAY) 1 CYCLE PRIOR TO FAILURE				272-453-1 2124-T851 TRANSVERSE UNSTRESSER 100% AIR 170.0 K 11.41 MM (14500 IN) 11.0 MPA (160.0 KSI) 6380 Cycles 88.62 MPA SORTIM (16.65 KSI SORTIM)			
CRACK LENGTH MM IN	IN	CYCLES	DELTA(A1)/DELTA(A2) MM/CYCLE IN/CYCLE	DELTA(Stress Intensity) MPA SORTIM KSI SORTIM	DELTA(Stress Intensity) MPA SORTIM KSI SORTIM	DELTA(Stress Intensity) MPA SORTIM KSI SORTIM	DELTA(Stress Intensity) MPA SORTIM KSI SORTIM
7.57	.277	1	.6743E-03	.2655E-04	16.69	18.18	
7.59	.289	824	.1364E-02	.4185E-04	20.69	18.93	
8.27	.324	1420	.1521E-02	.5947E-04	21.49	19.66	
8.42	.347	1413	.1555E-02	.7700E-04	22.27	20.28	
9.47	.373	2150	.1976E-02	.7740E-04	23.01	20.94	
10.74	.395	2434	.1773E-02	.6992E-04	23.68	21.65	
11.42	.418	2764	.2747E-02	.1082E-03	24.33	22.14	
11.14	.440	2955	.2414E-02	.1110E-03	25.05	22.80	
11.31	.459	3025	.2716E-02	.1065E-03	25.92	23.49	
12.55	.486	3477	.3020E-02	.1185E-03	26.57	24.18	
13.17	.505	3723	.3595E-02	.1415E-03	27.29	24.84	
13.99	.551	3936	.4681E-02	.1444E-03	27.90	25.39	
14.52	.572	4014	.4199E-02	.1716E-03	28.41	25.85	
15.13	.592	4134	.1071E-01	.4021E-03	29.29	26.62	
F 16.76	.640	4256	.6196E-02	.2400E-03	30.55	27.80	
F 17.78	.710	4536	.6196E-02	.2400E-03	31.94	29.06	
F 19.37	.754	4756	.9652E-02	.3800E-03	33.66	30.63	
F 21.72	.855	5034	.9525E-02	.3750E-03	35.44	32.29	
F 23.67	.910	5236	.9317E-02	.3647E-03	36.41	33.52	
F 25.12	.945	5356	.1604E-01	.6333E-03	39.35	34.90	
F 27.43	1.100	5546	.1397E-01	.5500E-03	35.46	36.26	
F 28.43	1.115	5606	.1775E-01	.7000E-03	41.74	37.36	
F 31.1	1.215	5726	.2132E-01	.8000E-03	42.40	38.67	
F 37.84	1.295	5806					
F 38.15	1.425	5034	.3505E-01	.1400E-02	44.57	40.56	
F 37.79	1.445	5054	.1144E-01	.1200E-02	46.41	42.26	
F 39.74	1.545	5136	.1304E-01	.1200E-02	47.46	43.26	
F 41.7	1.615	5146	.6445E-01	.1750E-02	48.74	44.35	
F 47.94	1.675	5074	.5101E-01	.2000E-02	45.97	45.44	
F 47.31	1.675	5034	.8361E-01	.2500E-02	50.94	46.35	
F 46.47	1.635	5136	.6667E-01	.2625E-02	42.34	47.65	
F 51.42	2.000	5174	.1300E-01	.4250E-02	54.49	44.95	
F 51.21	2.045	5034	.5037E-01	.2375E-02	57.35	52.19	
F 51.74	2.147	5036	.1143E-01	.4500E-02	58.46	53.39	
F 50.44	2.075	5046	.7607E-01	.3000E-02	50.66	54.25	
F 51.77	2.275	5056	.9925E-01	.3750E-02	60.94	55.48	
F 50.65	2.145	5074	.1778E-01	.7000E-02	62.14	56.74	
F 51.05	2.405	5246	.1524E-01	.6000E-02	63.42	57.89	
F 51.05	2.445	5096	.1705E-01	.7500E-02	66.30	59.11	
F 48.15	2.565	5326	.2109E-01	.8500E-02	68.57	60.68	
F 51.75	2.475	5713	.2794E-01	.1100E-01	68.70	61.89	
F 57.94	2.475	5716	.2794E-01	.1100E-01	65.14	62.93	
F 56.45	2.730	5726	.1504E-01	.7500E-02	70.57	64.18	
F 71.17	2.715	5731	.2542E-01	.1000E-01	71.94	65.41	
F 71.77	2.455	5734	.1302E-01	.1300E-01	73.14	66.56	
F 71.95	2.730	5745	.2521E-01	.1150E-01	75.17	68.41	
F 71.71	2.735	5751	.5018E-01	.2000E-01	77.68	71.69	
F 81.15	3.105	5751	.1041E-01	.4250E-01	74.90	72.73	
F 87.17	3.275	5755	.1547E-01	.6240E-01	82.56	75.14	

(a) Longitudinal



(b) Transverse



Alloy: 2124-T851

Stress Ratio: .05

Frequency: 200 cpm

Thickness: 11.47 mm (.450 inch)

Constraint: Unstiffened

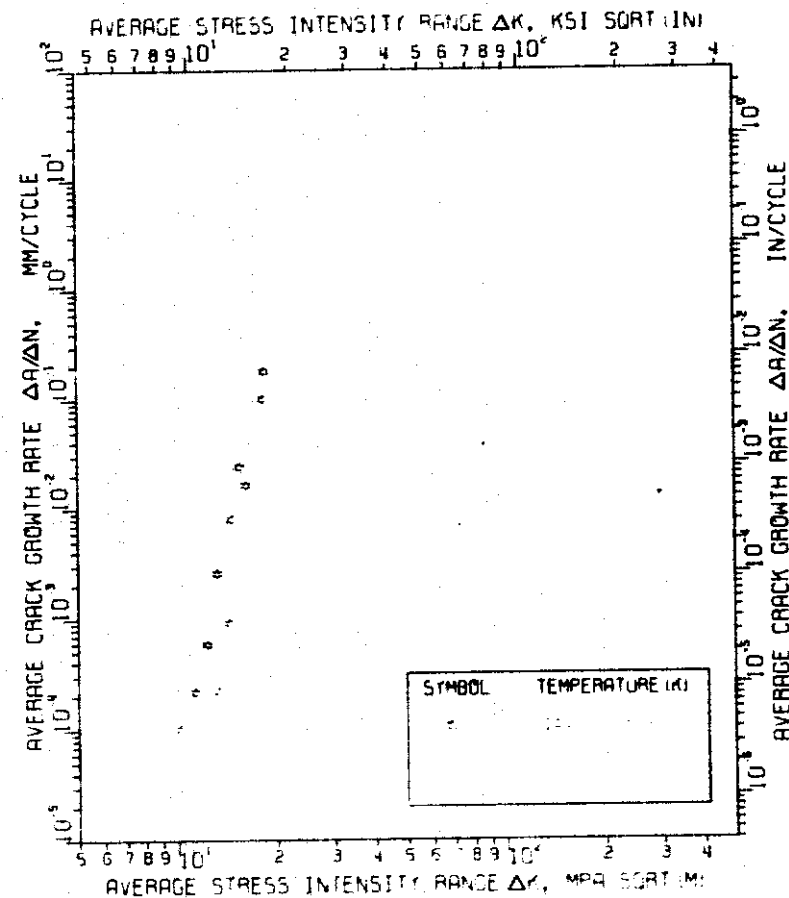
AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

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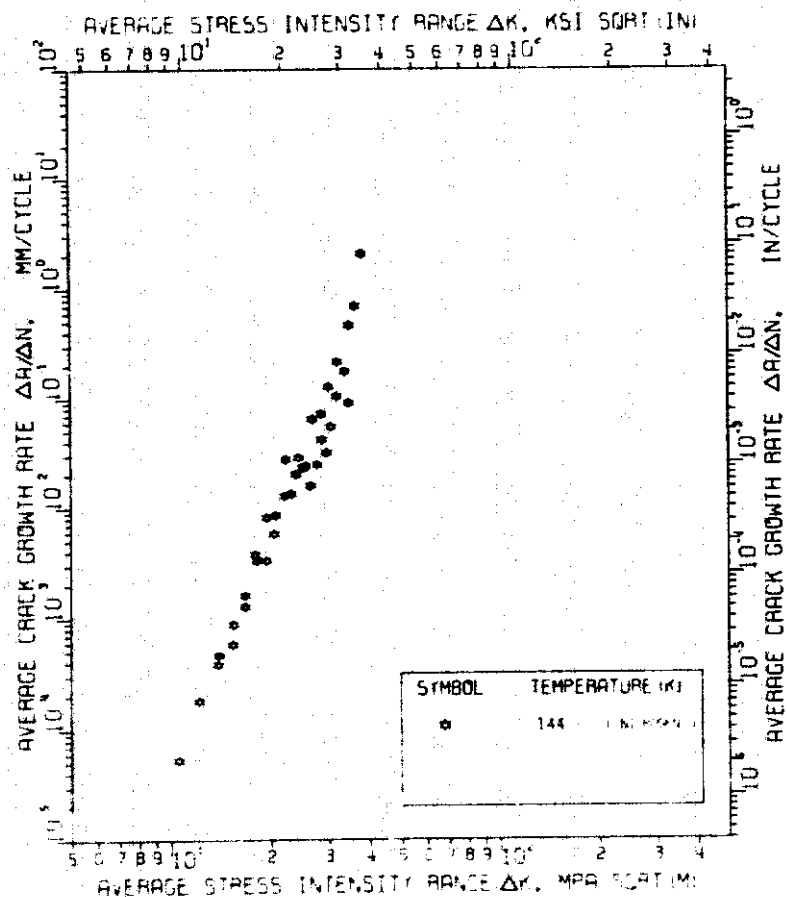
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(b) Transverse



(a) Longitudinal



Alloy: 2124-T851

Stress Ratio: .50

Frequency: 200 cpm

Thickness: 11.47 mm (.450 inch)

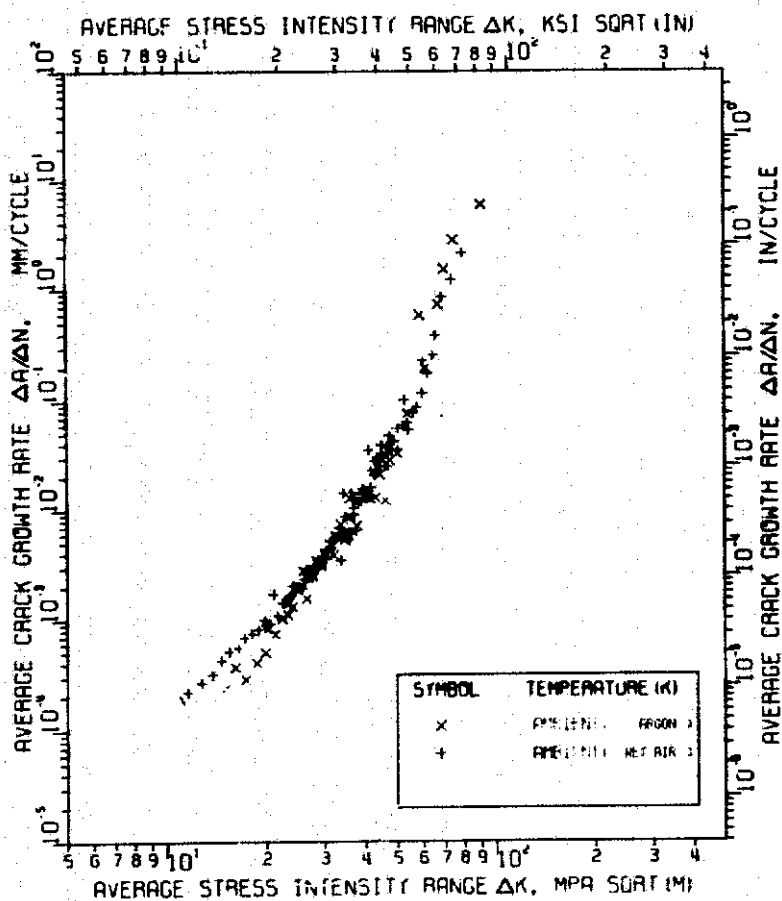
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AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

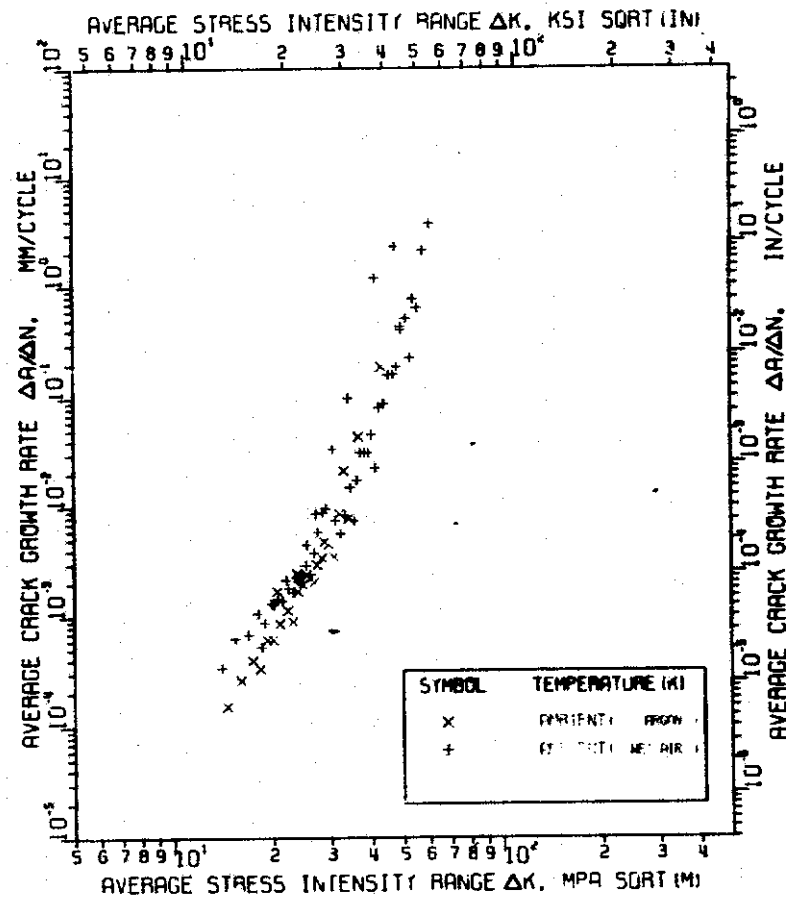
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FIGURE D6-2

(a) Longitudinal



(b) Transverse



Alloy: 2124-T851

Stress Ratio: .05

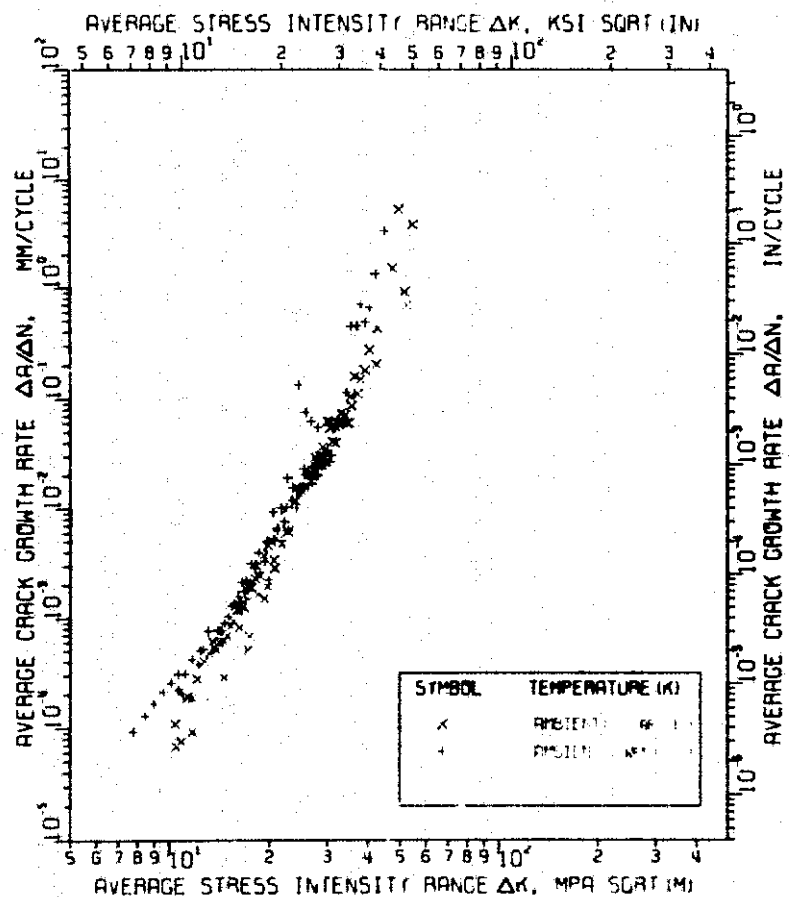
Frequency: 200 cpm

Thickness: 11.47 mm (.450 inch)

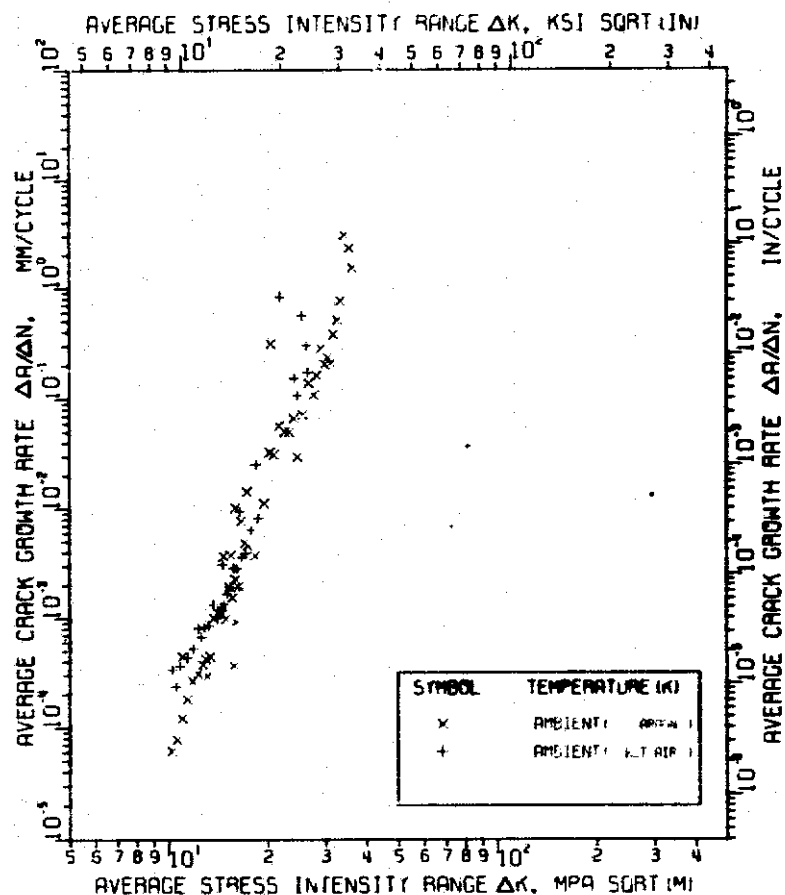
Constraint: Unstiffened

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

(a) Longitudinal



(b) Transverse



Alloy: 2124-T851

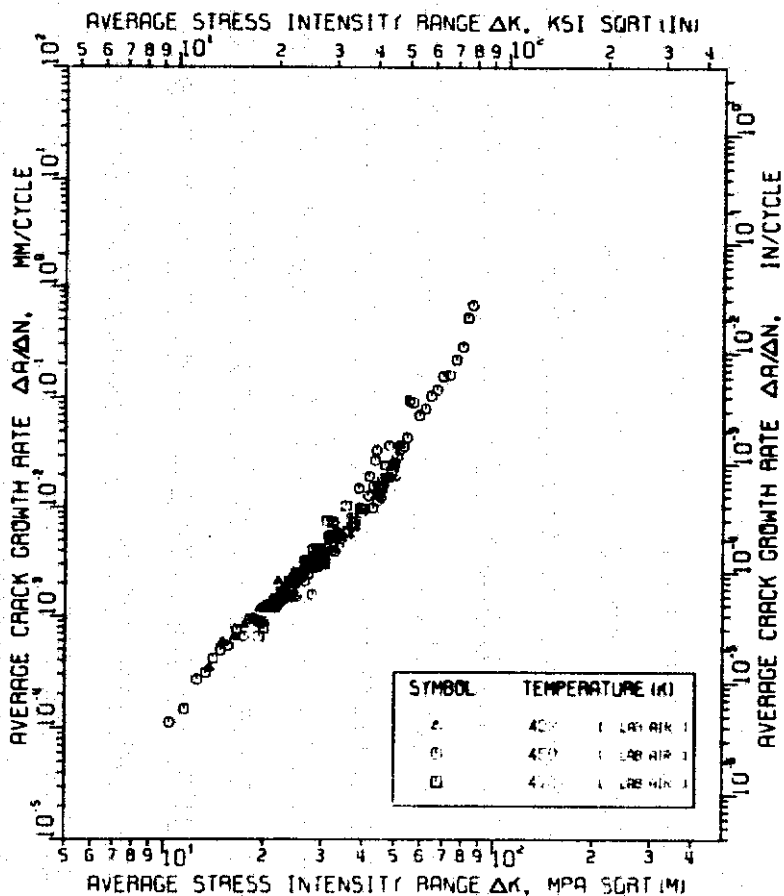
Stress Ratio: .50

Frequency: 200 cpm

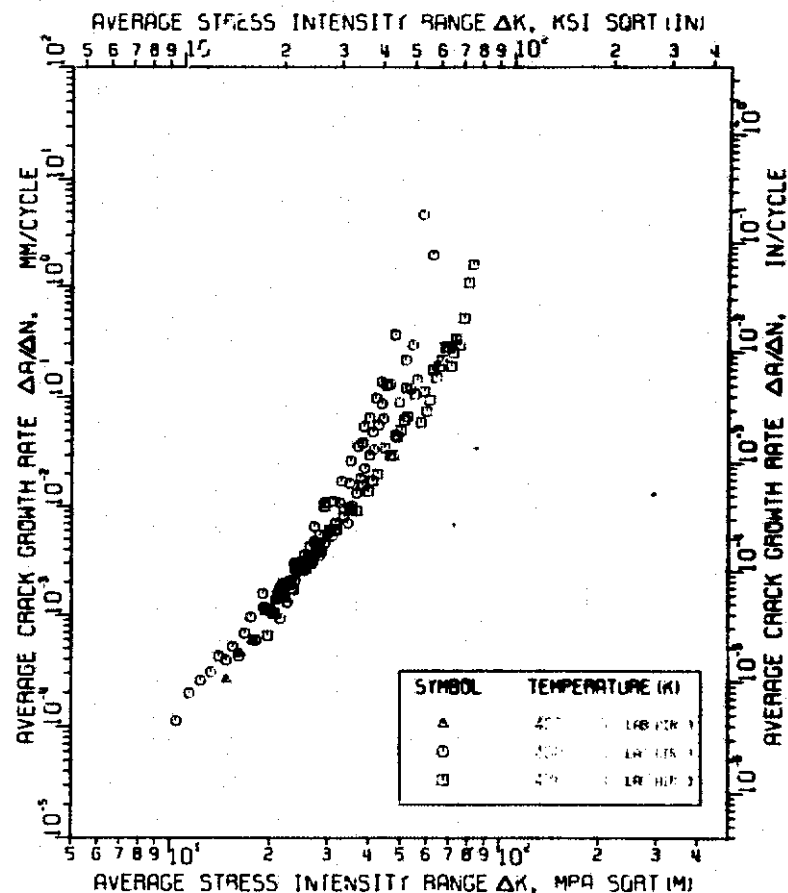
Thickness: 11.47 mm (.450 inch) Constraint: Unstiffened

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

(a) Longitudinal



(b) Transverse



Alloy: 2124-T851

Stress Ratio: .05

Frequency: 200 cpm

Thickness: 11.47 mm (.450 inch)

Constraint: Unstiffened

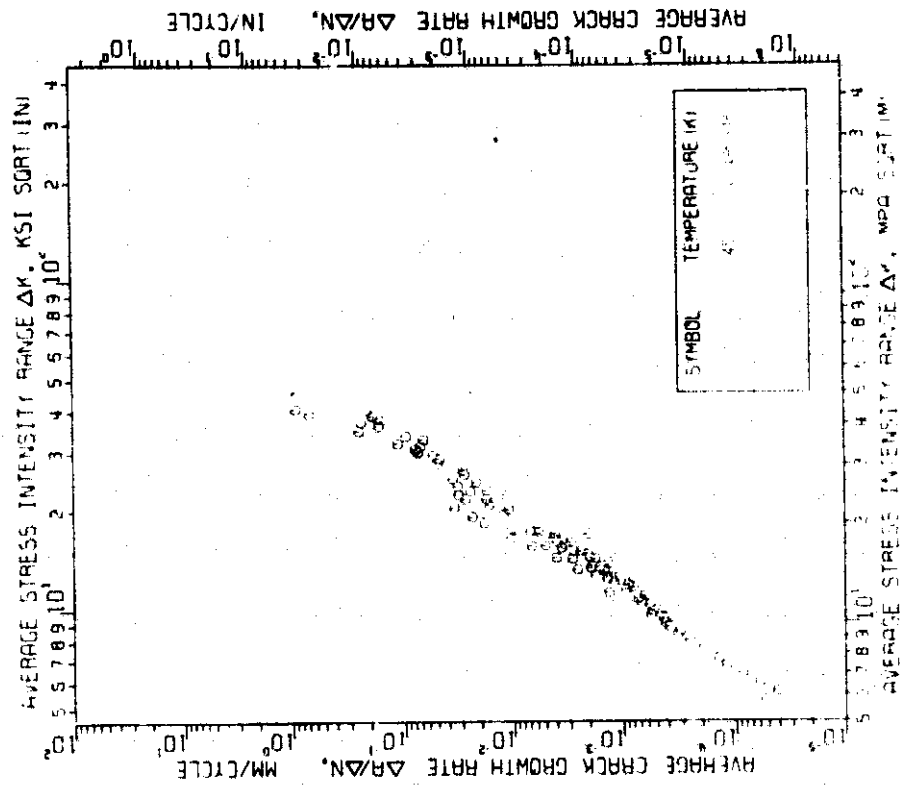
AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

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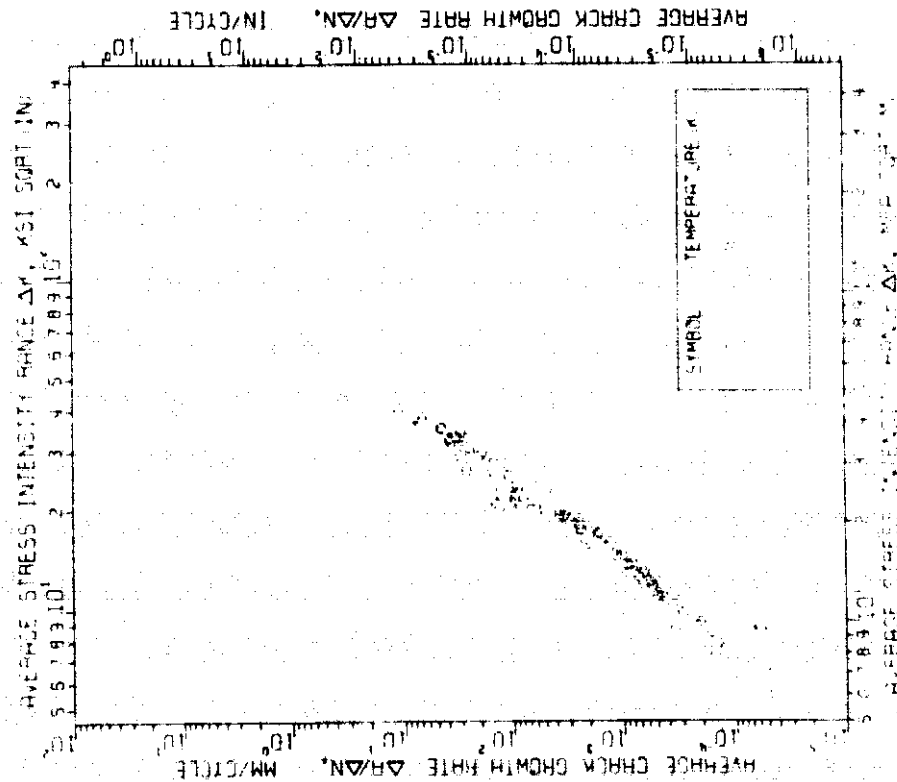
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(b) Transverse



(a) Longitudinal



Frequency: 200 cpm

Stress Ratio: .50

Alloy: 2124-T851

Thickness: 11.47 mm (.450 inch) Constraint: Unstiffened

AVERAGE CRACK GROWTH RATE AS A FUNCTION OF STRESS INTENSITY

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Appendix E

ANALYSIS OF CYCLIC TEST DATA

The following tables contain the results of an extensive analysis of the cyclic test data presented in Appendix D. This data was analyzed using both the Forman (Equation 4-3) and the Colliepriest (Equation 4-4) model for crack growth under cyclic loading conditions. The analysis employed a regression/convergence technique in which the rate coefficients and exponents for each model were determined using least squares techniques and the K_C and ΔK_0 values were optimized using iterative convergence routines. This technique is described in greater detail in Section 4.2.2.

A number of conventions have been followed in the preparation of the tables contained in this Appendix. Failure to converge on a K_C or ΔK_0 value is denoted by "FC". In addition, the results of each analysis are expressed in both SI units and the equivalent English system of units. Because the units on the coefficient term for the Forman and Paris rate models (i.e., C and C(P), respectively) are a function of the exponent term, the values of these parameters are reported in the appropriate data tables only as "SI UNITS" or "ENGLISH UNITS". For the Forman model, the coefficient term has units of

$$\frac{(\text{growth rate units})}{(\text{stress intensity units})^{n-1}}$$

For the Paris model, this term has units of

$$\frac{(\text{growth rate units})}{(\text{stress intensity units})^n}$$

When reported as SI units, these parameters yield a growth rate with units of m/cycle provided stress intensity has units of $\text{MPa}\sqrt{\text{m}}$. When reported in English

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units, these parameters yield a growth rate with units of inch/cycle, provided stress intensity has units of $\text{ksi}/\sqrt{\text{in}}$.

Since both models account for stress ratio effects, both analyses were conducted first using data from only one stress ratio ($R = .05$) and then using data from both stress ratios. Because of the large quantity of information contained in this appendix, the tabulated results are divided into the same sections as those used in Appendix D; na

<u>Section</u>	<u>Frequency</u>	<u>Alloy</u>	<u>Thickness</u>	
			<u>mm</u>	<u>in</u>
E1	200	2024-T861	1.60	.063
E2	200	2024-T861	3.18	.125
E3	200	2024-T861	6.35	.250
E4	20	2024-T861 2124-T851	6.35	.250
E5	200	2124-T851	6.35	.250
E6	200	2124-T851	11.47	.450

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SECTION E1. ANALYSIS OF FLAW GROWTH RATE DATA FOR 1.60 mm (.063 INCH) THICK 2024-T861

TABLE E1-1 OPTIMIZED FORMAN RATE PARAMETERS
FOR 1.60 mm (.063 inch) THICK 2024-T861 ALUMINUM
(R = .05, f = 200 cpm, BUCKLING RESTRAINED)

TEMPERATURE (°K)	ORIENTATION	K _c		C		n	STND. DEV.
		MPa m	ksi in	SI UNITS	ENGLISH UNITS		
144	L	63.2	57.5	.8214 E-12	.2043 E-10	5.870	.127
	T	44.2	40.2	.2142 E-10	.5881 E-9	4.825	.078
298 (ARGON)	L	74.0	67.3	.1554 E-8	.4851 E-7	3.461	.141
	T	57.6	52.4	.8477 E-10	.2414 E-8	4.438	.031
422	L	81.8	74.4	.9367 E-8	.3066 E-6	2.958	.109
	T	179.8	163.6	.2658 E-8	.8045 E-7	3.788	.196
450	L	99.9	90.9	.5407 E-8	.1702 E-6	3.262	.078
	T		*		FC	*	*
478	L	117.6	107.0	.5975 E-8	.1897 E-6	3.284	.182
	T		*		FC	*	*

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TABLE E1-2
OPTIMIZED COLLIEPRIEST RATE PARAMETERS FOR 1.60 mm (.063 INCH) THICK 2024-T861 ALUMINUM
(.05 stress ratio, 200 cpm frequency, buckling restrained)

TEMPERATURE (°K)	ORIENTATION	ΔK_0		K_C		EQUATION (4-2)			EQUATION (4-4)			STHD. DEV.
		MPa√m	ksi√in	MPa√m	ksi√in	SI UNITS	ENGLISH UNITS	C_2	SI UNITS	ENGLISH UNITS	$n(P)$	
144	L	*		*		FC		*		*		*
	T	12.4	11.2	43.9	39.9	.3950 E-5	.1555 E-3	3.609	.6483 E-13	.4365 E-11	5.695	.080
294 (AFSON)	L	7.8	7.1	79.5	72.3	.2295 E-5	.9034 E-4	4.238	.1829 E-10	.1016 E-8	3.652	.130
	T	*		*		FC		*		*		*
422	L	8.6	7.9	86.2	78.5	.3270 E-5	.1287 E-3	3.669	.8576 E-10	.4561 E-8	3.190	.098
	T	*		*		FC		*		*		*
450	L	1.4	1.3	145.6	132.5	.4155 E-6	.1636 E-4	7.372	.8126 E-10	.4323 E-8	3.195	.069
	T	8.1	7.3	102.0	92.8	.5302 E-5	.2087 E-3	4.337	.5493 E-10	.2985 E-8	3.420	.054
478	L	3.9	3.5	166.8	151.8	.2675 E-5	.1053 E-3	6.524	.3587 E-10	.1958 E-8	3.468	.183
	T	*		*		FC		*		*		*

TABLE E1-3 OPTIMIZED FORMAN RATE PARAMETERS
FOR 1.60 mm (.063 inch) THICK 2024-T861 ALUMINUM
(R = .05, f = 200 cpm, BUCKLING UNRESTRAINED)

TEMPERATURE (°K)	ORIENTATION	K_C		SI UNITS	C ENGLISH UNITS	n	STND. DEV.
		MPa m	ksi in				
144	L	*		FC		*	*
	T	55.1	50.1	.4021 E-12	.9647 E-11	6.255	.107
298 (ARGON)	L	76.7	69.8	.2894 E-9	.8557 E-8	4.038	.029
	T	53.0	48.2	.4975 E-9	.1489 E-7	3.910	.119
298 (WET)	L	67.5	61.4	.6670 E-9	.2013 E-7	3.818	.467
	T	50.1	45.6	.6631 E-9	.2005 E-7	3.802	.019
422	L	65.6	59.71	.3787 E-7	.1302 E-5	2.441	.025
	T	NT ⁺					
450	L	80.1	72.8	.2416 E-7	.8124 E-6	2.671	.041
	T	71.5	65.0	.1154 E-6	.4040 E-5	2.248	.046
478	L	85.9	78.2	.3206 E-8	.1013 E-6	3.337	.121
	T	67.1	61.0	.1098 E-6	.3859 E-5	2.206	.052

+ NO SPECIMENS TESTED

TABLE E1-4
OPTIMIZED COLLIEPRIEST RATE PARAMETERS FOR 1.60 mm (.063 INCH) THICK 2024-T861 ALUMINUM
(.05 stress ratio, 200 cpm frequency, buckling unrestrained)

TEMPERATURE	ORIENTATION	ΔK_0		K_C		EQUATION (4-2)		EQUATION (4-4)				STND. DEV.	
		MPa√m	ksi√in	MPa√m	ksi√in	SI UNITS	ENGLISH UNITS	C_1	C_2	SI UNITS	ENGLISH UNITS		N(P)
144	L	*	*	*	*		FC ΔK_0	*	*	*	*	*	*
	T	*	*	*	*		FC ΔK_0	*	*	*	*	*	*
294 (ARGON)	L	6.2	5.6	85.3	77.6	.1676 E-5	.6598 E-4	5.540	.3119 E-11	.1827 E-9	4.214	.026	
	T	6.1	5.6	59.3	54.0	.1497 E-5	.5892 E-4	4.868	.4824 E-11	.2845 E-9	4.289	.121	
294 (WET)	L	*	*	*	*		FC ΔK_0	*	*	*	*	*	*
	T	*	*	*	*		FC ΔK_0	*	*	*	*	*	*
422	L	12.3	11.2	66.0	60.1	.3891 E-5	.1532 E-3	2.580	.1297 E-9	.6822 E-8	3.077	.024	
	T						NT*						
450	L	11.8	10.7	81.8	74.5	.4978 E-5	.1960 E-3	3.053	.9964 E-10	.5279 E-8	3.149	.034	
	T	10.0	9.1	73.1	66.5	.4488 E-5	.1767 E-3	2.807	.3965 E-9	.2038 E-7	2.829	.046	
478	L	*	*	*	*		FC ΔK_0	*	*	*	*	*	*
	T	*	*	*	*		FC ΔK_0	*	*	*	*	*	*

* NO SPECIMENS TESTED

TABLE E1-5 OPTIMIZED FOREMAN RATE PARAMETERS
FOR 1.60 mm (.063 inch) THICK 2024-T861 ALUMINUM
(R = .05 & .50, f = 200 cpm, BUCKLING RESTRAINED)

TEMPERATURE (°K)	ORIENTATION	K_C		C		n	STND. DEV.
		MPa m	ksi in	SI UNITS	ENGLISH UNITS		
144	L	61.2	55.7	.8357 E-10	.2356 E-8	4.545	.227
	T	42.9	39.1	.1487 E-8	.4628 E-7	3.493	.105
298 (ARGON)	L	72.8	66.3	.2659 E-8	.8404 E-7	3.331	.176
	T	45.4	41.3	.1105 E-8	.3439 E-7	3.495	.114
450	L	107.7	98.0	.8206 E-8	.2630 E-6	3.183	.094
	T	74.8	68.0	.1451 E-7	.4784 E-6	2.880	.103

TABLE E1-6

OPTIMIZED COLLIEPRIEST RATE PARAMETERS FOR 1.60 mm (.063 INCH) THICK 2024-T861 ALUMINUM
(.05 & .50 stress ratio, 200 cpm frequency, buckling restrained)

TEMPERATURE (°K)	ORIENTATION	ΔK_{IC}		K_{IC}		EQUATION (4-2)			EQUATION (4-4)			STND. DEV.
		MPa√m	Ksi√in	MPa√m	Ksi√in	SI UNITS	ENGLISH UNITS	C_2	SI UNITS	ENGLISH UNITS	N(P)	
144	L	6.3	5.7	65.6	59.7	.1130 E-5	.4449 E-4	5.733	.4661 E-12	.2908 E-10	4.885	.176
	T	9.7	8.8	42.8	38.9	.2779 E-5	.1094 E-3	2.366	.1840 E-9	.9787 E-8	3.193	.168
294 (ARGON)	L	5.1	4.6	79.2	72.1	.1023 E-5	.4026 E-4	4.457	.6064 E-10	.3242 E-8	3.245	.165
	T	5.7	5.2	48.0	43.7	.6442 E-6	.2536 E-4	3.812	.2939 E-10	.1619 E-8	3.567	.105
450	L	4.8	4.4	110.1	100.2	.1957 E-5	.7704 E-4	4.191	.4480 E-7	.2270 E-7	2.657	.227
	T	7.7	7.0	76.5	69.6	.2957 E-5	.1164 E-3	3.088	.5405 E-9	.2744 E-7	2.696	.134

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SECTION E2. ANALYSIS OF FLAW GROWTH RATE DATA

FOR 3.18 mm (.125 INCH) THICK 2024-T861

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TABLE E2-1 OPTIMIZED FORMAN RATE PARAMETERS
FOR 3.18 mm (.125 inch) THICK 2024-T861 ALUMINUM
(R = .05, f = 200 cpm, BUCKLING RESTRAINED)

TEMPERATURE (°K)	ORIENTATION	K_C		C		n	STND. DEV.
		MPa m	ksi in	SI UNITS	ENGLISH UNITS		
144	L	60.0	54.6	.5756 E-11	.1503 E-9	5.359	.086
	T		*		FC	*	*
298 (ARGON)	L	61.5	56.0	.4234 E-10	.1174 E-8	4.718	.096
	T	41.9	38.1	.1767 E-11	.4475 E-10	5.680	.086
422	L		*		FC	*	*
	T	88.1	80.2	.7581 E-8	.2396 E-6	3.331	.091
450	L		*		FC	*	*
	T	133.8	121.8	.1189 E-7	.3743 E-6	3.374	.070
478	L		*		FC	*	*
	T		*		FC(K_C)	*	*

TABLE E2-2
OPTIMIZED COLLIEPRIEST RATE PARAMETERS FOR 3.18 mm (.125 INCH) THICK 2024-T861 ALUMINUM
(.05 stress ratio, 200 cpm frequency, buckling restrained)

TEMPERATURE (°K)	ORIENTATION	ΔK_0		K_C		EQUATION (4-2)		EQUATION (4-4)		STND. DEV.		
		MPa√m	ksi√in	MPa√m	ksi√in	C_1	C_2	$C(P)$	$N(P)$			
						SI UNITS	ENGLISH UNITS					
144	L	12.4	11.3	64.9	59.0	.1098 E-4	.4323 E-3	4.836	.3530 E-13	.2411 E-11	5.846	.081
	T	*	*	*	*	FC		*	*	*	*	*
294 (ARGON)	L	5.7	5.2	71.3	64.9	.1483 E-5	.5838 E-4	6.136	.6514 E-12	.4058 E-10	4.868	.093
	T	6.7	6.1	46.8	42.6	.9004 E-6	.3545 E-4	5.832	.2742 E-13	.1903 E-11	6.016	.085
422	L	*	*	*	*	FC(ΔK_0)		*	*	*	*	*
	T	13.4	12.4	89.9	81.8	.2088 E-4	.8220 E-3	3.369	.7294 E-10	.4010 E-8	3.541	.073
450	L	13.6	12.4	180.4	164.2	.3596 E-4	.1416 E-2	3.510	.9084 E-9	.4619 E-7	2.713	.046
	T	12.4	11.3	123.2	112.2	.3097 E-4	.1219 E-2	3.819	.1583 E-9	.8525 E-8	3.324	.055
478	L	11.3	10.3	196.8	179.1	.3541 E-4	.1394 E-2	4.310	.3112 E-9	.1629 E-7	3.020	.031
	T	12.2	11.1	150.6	137.1	.3469 E-4	.1366 E-2	3.681	.5860 E-9	.3040 E-7	2.925	.069

TABLE E2-3 OPTIMIZED FORMAN RATE PARAMETERS
FOR 3.18 mm (.125 inch) THICK 2024-T861 ALUMINUM
(R = .05, f = 200 cpm, BUCKLING UNRESTRAINED)

TEMPERATURE (°K)	ORIENTATION	K_C		C		n	STND. DEV.
		MPa m	ksi in	SI UNITS	ENGLISH UNITS		
144	L	58.4	53.2	.9268 E-12	.2284 E-10	5.967	.049
	T	*	*	FC(K_C)		*	*
298 (ARGON)	L	*	*	FC		*	*
	T	52.1	47.4	.1299 E-11	.3223 E-10	5.893	.174
298 (WET)	L	66.0	60.0	.1950 E-5	.5622 E-8	4.306	.075
	T	37.4	34.1	.4325 E-9	.1305 E-7	3.819	.049
422	L	*	*	FC		*	*
	T	*	*	FC		*	*
450	L	133.0	121.0	.1945 E-7	.6280 E-6	3.103	.112
	T	99.7	90.8	.4281 E-7	.1416 E-5	2.848	.103
478	L	*	*	FC		*	*
	T	*	*	FC		*	*

TABLE E2-4
OPTIMIZED COLLIEPRIEST RATE PARAMETERS FOR 3.18 mm (.125 INCH) THICK 2024-T861 ALUMINUM
(.05 stress ratio, 200 cpm frequency, buckling unrestrained)

TEMPERATURE (°K)	ORIENTATION	ΔK_0		K_C		EQUATION (4-2)		C_2	EQUATION (4-4)		STND. DEV.
		MPa \sqrt{m}	ksi \sqrt{in}	MPa \sqrt{m}	ksi \sqrt{in}	SI UNITS	ENGLISH UNITS		$C(P)$	N(P)	
144	L	6.5	5.9	70.9	64.5	.2094 E-5	.8245 E-4	7.419	.1180 E-13	.8331 E-12	6.199 .044
	T	15.3	13.9	39.6	36.0	.1400 E-4	.5513 E-3	3.889	.5963 E-16	.5073 E-14	8.173 .032
294 (ARGON)	L	7.6	6.9	96.4	87.7	.9938 E-5	.3912 E-3	6.549	.3934 E-12	.2520 E-10	5.165 .344
	T	*	*	*	*	FC(ΔK_0)		*	*	*	*
294 (WET)	L	0.55	0.50	82.9	75.4	.2892 E-7	.1139 E-5	8.412	.4868 E-10	.2628 E-8	3.350 .034
	T	*	*	*	*	FC(ΔK_0)		*	*	*	*
422	L	12.4	11.3	92.2	83.9	.1459 E-4	.5746 E-3	3.886	.1723 E-10	.9776 E-9	3.876 .012
	T	*	*	*	*	FC(ΔK_0)		*	*	*	*
450	L	12.2	11.1	128.6	117.0	.2006 E-4	.7896 E-3	3.770	.1536 E-9	.8175 E-8	3.202 .102
	T	13.3	12.1	1020	92.9	.2157 E-4	.8492 E-3	3.163	.2970 E-9	.1567 E-7	3.104 .082
478	L	*	*	*	*	FC(ΔK_0)		*	*	*	*
	T	*	*	*	*	FC(K_C)		*	*	*	*

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TABLE E2-5 OPTIMIZED FORMAN RATE PARAMETERS
FOR 3.18 mm (.125 inch) THICK 2024-T861 ALUMINUM
(R = .05 & .50, f = 200 cpm, BUCKLING RESTRAINED)

TEMPERATURE (°K)	ORIENTATION	K_C		C		n	STND. DEV.
		MPa m	ksi in	SI UNITS	ENGLISH UNITS		
144	L	56.4	51.3	.1016 E-8	.3055 E-7	3.856	.309
	T	*		FC(K_C)		*	*
298 (ARGON)	L	71.7	65.3	.3321 E-9	.9567 E-8	4.314	.345
	T	48.3	44.0	.7854 E-10	.2147 E-8	4.868	.700
450	L	129.1	117.5	.1589 E-6	.5424 E-5	2.514	.104
	T	102.0	92.8	.4697 E-7	.1505 E-5	2.956	.356

TABLE E2-6
OPTIMIZED COLLIEPRIEST RATE PARAMETERS FOR 3.18 mm (.125 INCH) THICK 2024-T861 ALUMINUM
(.05 & .50 stress ratio, 200 cpm frequency, buckling restrained)

TEMPERATURE (°K)	ORIENTATION	ΔK_0		K_c		EQUATION (4-2)		EQUATION (4-4)		N(P)	STND. DEV.
		MPa√m	ksi√in	MPa√m	ksi√in	C_1	C_2	$C(P)$			
						SI UNITS	ENGLISH UNITS		ENGLISH UNITS		
144	L	5.7	5.2	61.2	55.7	.1290 E-5	.5080 E-4	5.116	.4172 E-11	.2467 E-9	4.317 .180
	T	*		*		FC(ΔK_0)		*	*	*	*
294 (ARGON)	L	4.6	4.2	78.9	71.8	.1442 E-5	.5678 E-4	5.981	.5612 E-11	.3289 E-9	4.221 .254
	T	3.1	2.8	54.5	49.6	.2202 E-6	.8671 E-5	6.970	.8386 E-12	.5222 E-10	4.863 .228
450	L	*		*		FC(ΔK_0)		*	*	*	*
	T	*		*		FC(ΔK_0)		*	*	*	*

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SECTION E3. ANALYSIS OF FLAW GROWTH RATE DATA FOR 6.35 mm (.250 INCH) THICK 2024-T861

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TABLE E3-1 OPTIMIZED FORMAN RATE PARAMETERS
FOR 6.35 mm (.250 inch) THICK 2024-T861 ALUMINUM
(R = .05, f = 200 cpm)

TEMPERATURE (°K)	ORIENTATION	K_C		C		n	STND. DEV.
		MPa m	ksi in	SI UNITS	ENGLISH UNITS		
144	L	52.2	47.5	.4946 E-16	.9022 E-15	9.163	.147
	T	35.3	32.1	.3804 E-18	.5859 E-17	10.956	.672
298 (ARGON)	L	*		FC(K_C)		*	*
	T	28.1	25.6	.1562 E-11	.4030 E-10	5.485	.048
298 (WET)	L	28.5	25.9	.9966 E-8	.3432 E-6	2.421	.013
	T	*		FC(K_C)		*	*
422	L	158.7	144.4	.4776 E-8	.1479 E-6	3.549	.123
	T	81.6	74.3	.1617 E-11	.4103 E-10	5.659	.053
450	L	*		FC		*	*
	T	*		FC		*	*
478	L	*		FC		*	*
	T	*		FC		*	*

TABLE E3-2
OPTIMIZED COLLIEPRIEST RATE PARAMETERS FOR 6.35 mm (.250 INCH) THICK 2024-T861 ALUMINUM
(.05 stress ratio, 200 cpm frequency)

TEMPERATURE (°K)	ORIENTATION	ΔK_0		K_C		EQUATION (4-2)		EQUATION (4-4)			STND. DEV.
		MPa√m	ksi√in	MPa√m	ksi√in	C_1	C_2	$C(P)$	N(P)		
						SI UNITS	ENGLISH UNITS		SI UNITS	ENGLISH UNITS	
144	L	*		*			FC	*		*	*
	T	*		*			FC(ΔK_0)	*		*	*
294 (ARGON)	L	*		*			FC(ΔK_0)	*		*	*
	T	*		*			FC(ΔK_0)	*		*	*
294 (WET)	L	0.09	0.08	36.9	33.6	.4018 E-8	.1582 E-6	5.509	.1347 E-8	.6301 E-7	1.830 .012
	T	*		*			FC(ΔK_0)	*		*	*
422	L	*		*			FC(K_C)	*		*	*
	T	8.5	7.7	111.0	101.1	.7762 E-5	.3056 E-3	7.920	.5536 E-14	.3893 E-12	6.153 .058
450	L	11.8	10.7	138.2	125.8	.9703 E-4	.3820 E-2	5.776	.2815 E-11	.1725 E-9	4.693 .042
	T	*		*			FC	*		*	*
478	L	*		*			FC(K_C)	*		*	*
	T	*		*			FC	8		8	*

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SECTION E4. ANALYSIS OF FLAW GROWTH RATE DATA FOR 6.35 mm (.250 INCH)
THICK 2024-T861 AND 2124-T851 (CYCLIC FREQUENCY: 20 CPM)

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TABLE E4-1 OPTIMIZED FORMAN RATE PARAMETERS
FOR 6.35 mm (.250 inch) THICK 2024-T861 AND 2124-T851 ALUMINUM
(R = .05, f = 20 cpm)

TEMPERATURE (°K)	ALLOY	K_C		C		n	STND. DEV.
		MPa m	ksi in	SI UNITS	ENGLISH UNITS		
298 (ARGON)	2024-T861	*		FC(K_C)		*	*
	2124-T851	57.5	52.3	.3521 E-12	.8704 E-11	5.938	.661
298 (WET)	2024-T861	25.3	23.0	.6746 E-8	.2307 E-6	2.496	.036
	2124-T851	61.0	55.5	.9289 E-12	.2348 E-10	5.701	.485
450	2024-T861	132.8	120.8	.1791 E-9	.4887 E-8	4.889	.025
	2124-T851	99.3	90.3	.8477 E-8	.2743 E-6	3.081	.036

TABLE E4-2
OPTIMIZED COLLIEPRIEST RATE PARAMETERS FOR 6.35 mm (.250 INCH) THICK 2024-T861 AND 2124-T851 ALUMINUM
(.05 stress ratio, 20 cpm frequency)

TEMPERATURE (°K)	ALLOY	ΔK_0		K_{IC}		EQUATION (4-2)			EQUATION (4-4)		STND. DEV.
		MPa√m	ksi√in	MPa√m	ksi√in	C_1	C_2	$n(P)$			
						SI UNITS	ENGLISH UNITS		SI UNITS	ENGLISH UNITS	
294 (ARGON)	2024-T861	*	.	*			FC ΔK_0	*		*	*
	2124-T851	*		*			FC ΔK_0	*		*	*
294 (WET)	2024-T861	7.7	7.0	25.3	23.0	.4453 E-6	.1753 E-4	2.259	.1993 E-10	.1122 E-8	3.799 .037
	2124-T851	*		*			FC ΔK_0	*		*	*
450	2024-T861	4.0	3.6	201.6	183.5	.2046 E-4	.8056 E-3	9.914	.9227 E-12	.5851 E-10	5.056 .026
	2124-T851	7.4	6.8	116.8	106.3	.4119 E-5	.1621 E-3	4.723	.3777 E-10	.2054 E-8	3.429 .035

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**SECTION E5. ANALYSIS OF FLAW GROWTH RATE DATA
FOR 6.35 mm (.250 INCH) THICK 2124-T851**

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TABLE E5-1 OPTIMIZED FORMAN RATE PARAMETERS
FOR 6.35 mm (.250 inch) THICK 2124-T851 ALUMINUM
(R = .05, f = 200 cpm)

TEMPERATURE (°K)	ORIENTATION	K_C		SI UNITS	C ENGLISH UNITS	n	STND. DEV.
		MPa m	ksi in				
144	L	103.1	93.8	.6724 E-11	.1833 E-9	4.899	.634
	T	58.2	53.0	.4802 E-12	.1205 E-10	5.774	.114
298 (ARGON)	L	95.3	86.7	.4152 E-0	.1253 E-7	3.822	.111
	T	53.2	48.4	.2643 E-10	.7421 E-9	4.585	.316
298 (WET)	L	99.6	90.7	.1015 E-7	.3330 E-6	2.935	.066
	T	40.9	37.2	.9913 E-8	.3336 E-6	2.666	.065
422	L	203.4	185.1	.3636 E-8	.1145 E-6	3.373	.036
	T		*		FC	*	*
450	L	108.5	98.7	.8441 E-8	.2734 E-6	3.071	.019
	T		*		FC(K_C)	*	*
478	L		*		FC	*	*
	T		*		FC	*	*

TABLE E5-2
OPTIMIZED COLLIEPRIEST RATE PARAMETERS FOR 6.35 mm (.250 INCH) THICK 2124-T851 ALUMINUM
(.05 stress ratio, 200 cpm frequency)

TEMPERATURE (°K)	ORIENTATION	ΔK_0		K_C		EQUATION (4-2)			EQUATION (4-4)			STND. DEV.
		MPa√m	ksi√in	MPa√m	ksi√in	C_1	C_2	$n(P)$				
						SI UNITS	ENGLISH UNITS		SI UNITS	ENGLISH UNITS		
144	L	*		*		FC		*	*		*	
	T	*		*		FC(ΔK_0)		*	*		*	
294 (ARGON)	L	8.4	7.7	106.2	96.7	.2831 E-5	.1114 E-3	5.032	.3907 E-11	.2223 E-9	3.971 .116	
	T	3.1	2.8	60.4	55.0	.1282 E-6	.5048 E-5	6.330	.2021 E-11	.1187 E-9	4.239 .300	
294 (WET)	L	4.4	4.0	136.3	124.1	.1598 E-5	.6290 E-4	5.583	.4934 E-10	.2639 E-8	3.249 .068	
	T	12.4	11.3	40.2	36.6	.2283 E-5	.8988 E-4	2.035	.4873 E-10	.2659 E-8	3.462 .065	
422	L	*		*		FC(ΔK_0)		*	*		*	
	T	*		*		FC		*	*		*	
450	L	*		*		FC(ΔK_0)		*	*		*	
	T	10.2	9.2	87.0	79.1	.7137 E-5	.2810 E-3	4.054	.1967 E-10	.1105 E-8	3.775 .093	
478	L	16.0	14.6	290.4	264.3	.2454 E-4	.9660 E-3	3.551	.7799 E-9	.3869 E-7	2.452 .018	
	T	*		*		FC(ΔK_0)		*	*		*	

TABLE E5-3 OPTIMIZED FORMAN RATE PARAMETERS
FOR 6.35 mm (.250 inch) THICK 2124-T851 ALUMINUM
(R = .05 & .50, f = 200 cpm, BUCKLING RESTRAINED)

TEMPERATURE (°K)	ORIENTATION	K_C		C		n	STND. DEV.
		MPa m	ksi in	SI UNITS	ENGLISH UNITS		
144	L	102.2	93.0	.7572 E-9	.2286 E-7	3.816	.855
	T	62.9	57.2	.2583 E-10	.6957 E-9	5.026	.879
298 (ARGON)	L	93.7	85.3	.2790 E-8	.8770 E-7	3.389	.408
	T	66.8	60.8	.2030 E-9	.5883 E-8	4.252	.536
298 (WET)	L	85.2	77.5	.1067 E-7	.3535 E-6	2.834	.150
	T	67.0	60.9	.2953 E-9	.8468 E-8	4.362	.409
405	L	125.6	114.3	.9771 E-8	.3154 E-6	3.107	.047
	T	141.7	129.0	.4280 E-8	.1319 E-6	3.596	.102

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TABLE E5-4
OPTIMIZED COLLIEPRIEST RATE PARAMETERS FOR 6.35 mm (.250 INCH) THICK 2124-T851 ALUMINUM
(.05 & .50 stress ratio, 200 cpm frequency)

TEMPERATURE (°K)	ORIENTATION	ΔK_0		K_C		EQUATION (4-2) C_1		C_2	EQUATION (4-4) $C(P)$		N(P)	STND. DEV.
		MPa√m	ksi√in	MPa√m	ksi√in	SI UNITS	ENGLISH UNITS		SI UNITS	ENGLISH UNITS		
144	L	1.04	.95	120.1	109.3	.3302 E-7	.1300 E-5	8.497	.5818 E-11	.3210 E-9	3.580	.330
	T	*		*		FC(ΔK_0)		*		*	*	*
294 (ARGON)	L	1.83	1.67	155.2	141.2	.2341 E-6	.9217 E-5	8.883	.2886 E-11	.1657 E-9	4.002	.229
	T	8.6	7.8	77.7	70.7	.3772 E-5	.1485 E-3	5.000	.1467 E-11	.8857 E-10	4.539	.469
294 (WET)	L	7.6	6.9	96.1	87.4	.2137 E-5	.8413 E-4	3.834	.9947 E-10	.5208 E-8	3.025	.125
	T	*		*		FC(K_C)		*		*	*	*
450	L	9.0	8.2	100.6	91.5	.4025 E-5	.1585 E-3	3.030	.7612 E-9	.3799 E-7	2.516	.186
	T	9.0	8.2	114.9	104.5	.8421 E-5	.3315 E-3	3.591	.4731 E-9	.2430 E-7	2.820	.218

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SECTION E6. ANALYSIS OF FLAW GROWTH RATE DATA
FOR 11.47 mm (.450 INCH) THICK 2124-T851

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TABLE E6-1 OPTIMIZED FORMAN RATE PARAMETERS
FOR 11.43 mm (.450 inch) THICK 2124-T851 ALUMINUM
(R = .05, f = 200 cpm)

TEMPERATURE (°K)	ORIENTATION	K_C		C		n	STND. DEV.
		MPa m	ksi in	SI UNITS	ENGLISH UNITS		
144	L	83.5	76.0	.1604 E-12	.3946 E-11	5.992	.084
	T	*		FC(K_C)		*	*
298 (ARGON)	L	100.8	91.7	.4824 E-10	.1360 E-8	4.542	.230
	T	47.4	43.1	.1410 E-9	.4224 E-8	3.900	.122
298 (WET)	L	86.7	78.9	.1694 E-8	.5276 E-7	3.489	.087
	T	66.3	60.3	.2794 E-10	.7695 E-9	4.791	.548
422	L	*		FC(K_C)		*	*
	T	*		FC(K_C)		*	*
450	L	99.2	90.3	.8119 E-8	.2637 E-6	3.040	.053
	T	67.1	61.1	.3724 E-9	.1109 E-7	3.964	.255
478	L	*		FC(K_C)		*	*
	T	95.5	86.9	.3113 E-8	.9781 E-7	3.394	.059

TABLE E6-2
OPTIMIZED COLLIEPRIEST RATE PARAMETERS FOR 11.43 mm (.450 INCH) THICK 2124-T851 ALUMINUM
(.05 stress ratio, 200 cpm frequency)

TEMPERATURE (°K)	ORIENTATION	ΔK_0		K_c		EQUATION (4-2)		EQUATION (4-4)		N(P)	STHD. DEV.
						SI UNITS	ENGLISH UNITS	SI UNITS	ENGLISH UNITS		
144	L	*	*	*	*	FC(ΔK_0)		*	*	*	*
	T	*	*	*	*	FC(ΔK_0)		*	*	*	*
294 (ARGON)	L	*	*	*	*	FC(K_c)		*	*	*	*
	T	5.7	5.2	51.8	47.2	.3105 E-6	.1222 E-4	4.713	.1604 E-11	.9348 E-10	4.277 .121
294 (NET)	L	*	*	*	*	FC(K_c)		*	*	*	*
	T	*	*	*	*	FC(ΔK_0)		*	*	*	*
422	L	*	*	*	*	FC(ΔK_0)		*	*	*	*
	T	*	*	*	*	FC(ΔK_0)		*	*	*	*
450	L	0.06	0.05	187.5	170.7	.8387 E-8	.3302 E-6	9.724	.4568 E-9	.2258 E-7	2.414 .058
	T	*	*	*	*	FC(ΔK_0)		*	*	*	*
478	L	15.9	14.4	62.0	56.4	.4411 E-5	.1737 E-3	2.187	.7028 E-10	.3743 E-8	3.207 .046
	T	14.2	12.9	99.8	90.9	.1298 E-4	.5111 E-3	3.630	.1788 E-10	.9996 E-9	3.720 .055

TABLE E6-3 OPTIMIZED FORMAN RATE PARAMETERS
FOR 11.43 mm (.450 inch) THICK 2124-T851 ALUMINUM
(R = .05 & .50, f = 200 cpm, BUCKLING RESTRAINED)

TEMPERATURE (°K)	ORIENTATION	K _C		C		n	STND. DEV.
		MPa m	ksi in	SI UNITS	ENGLISH UNITS		
144	L	78.9	71.8	.5441 E-9	.1631 E-7	3.894	.589
	T	51.3	46.7	.4973 E-9	.1478 E-7	3.982	2.74
298 (ARGON)	L	112.2	102.1	.1380 E-9	.3926 E-8	4.445	.407
	T	72.8	66.3	.5910 E-10	.1629 E-8	4.782	1.21
298 (WET)	L	*		FC(K _C)		*	*
	T	65.0	59.2	.7687 E-9	.2301 E-7	3.907	.986
450	L	102.7	93.5	.9112 E-8	.2959 E-6	3.044	.114
	T	98.1	89.3	.2379 E-8	.7260 E-7	3.701	.344

TABLE E6-4
OPTIMIZED COLLIEPRIEST RATE PARAMETERS FOR 11.43 mm (.450 INCH) THICK 2124-T851 ALUMINUM
(.05 & .50 stress ratio, 200 cpm frequency)

TEMPERATURE (°K)	ORIENTATION	ΔK_0		K_C		EQUATION (4-2)			EQUATION (4-4)			STND. DEV.
		MPa√m	ksi√in	MPa√m	ksi√in	C_1	C_2	$C(P)$	$N(P)$			
						SI UNITS	ENGLISH UNITS		SI UNITS	ENGLISH UNITS		
144	L	2.2	2.0	107.4	97.8	.9730 E-7	.3831 E-5	8.922	.3824 E-12	.2316 E-10	4.569	.193
	T	*		*		FC(K_C)		*		*	*	*
294 (ARGON)	L	4.4	4.0	145.9	132.8	.1663 E-5	.6551 E-4	7.662	.1140 E-11	.6785 E-10	4.386	.208
	T	*		*		FC(ΔK_0)		*		*	*	*
294 (WET)	L	3.3	3.0	102.2	93.0	.6377 E-6	.2510 E-4	5.962	.2635 E-10	.1439 E-8	3.470	.135
	T	0.17	0.16	129.5	117.9	.1085 E-8	.4272 E-7	13.994	.1490 E-11	.8744 E-10	4.232	.563
450	L	4.5	4.1	109.2	99.4	.1318 E-5	.5189 E-4	4.407	.2632 E-9	.1343 E-7	2.754	.179
	T	*		*		FC(K_C)		*		*	*	*

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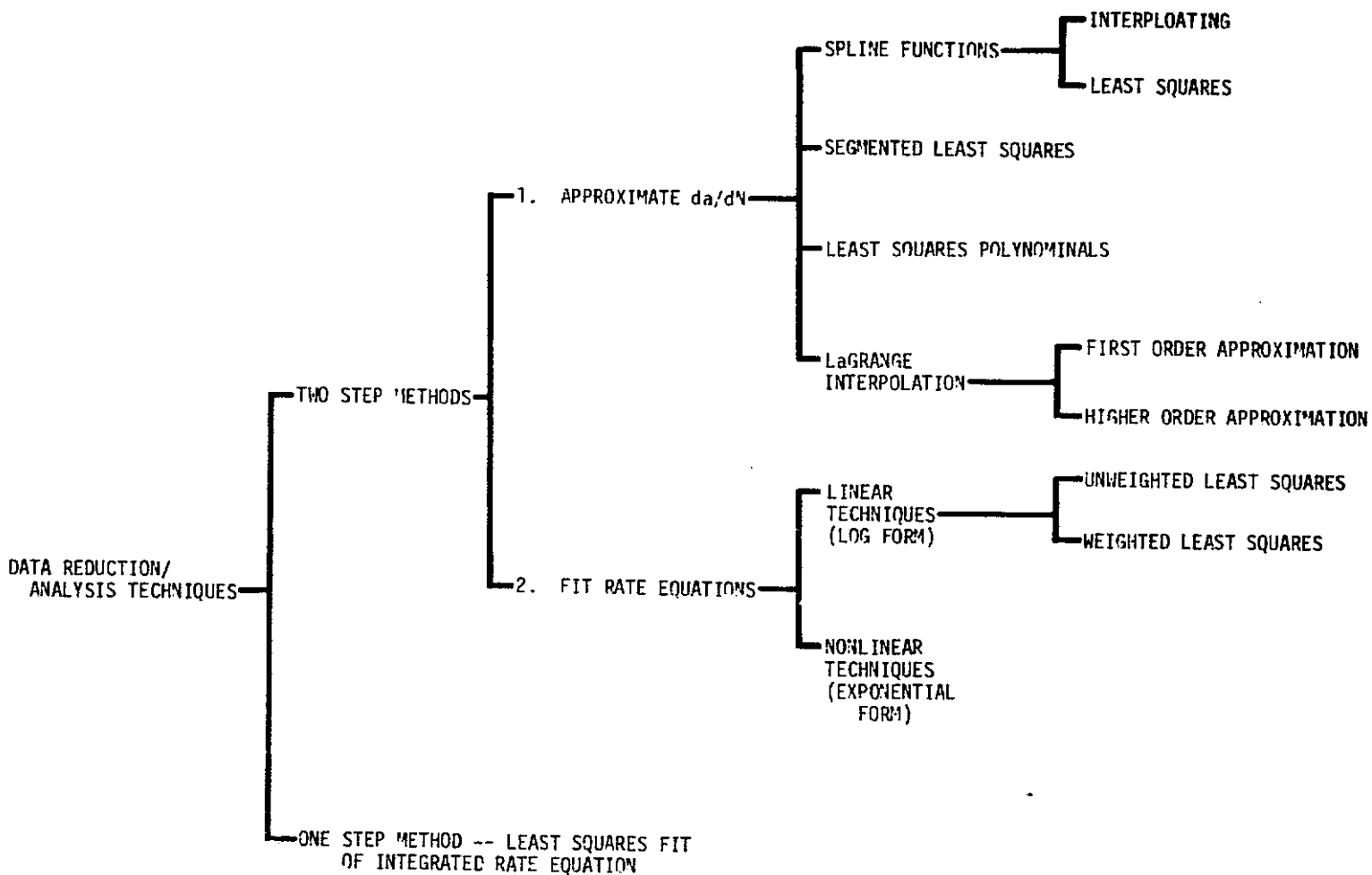
Appendix F

ALTERNATIVE CYCLIC DATA ANALYSIS TECHNIQUES

No standard technique has as yet been established to reduce raw specimen data (i.e., stress/crack length/cycle measurements) to $(da/dN, \Delta K)$ data or to analyze this data to establish the growth rate parameters associated with the Forman and Colliepriest rate models, equations (4-3) and 4-4). As a result, several techniques were considered, as summarized in Figure F-1.

Basically, two different approaches can be used to evaluate the growth rate parameters associated with these models. The more commonly used approach consists of two steps; first, approximations are used to establish the derivative of the (N,a) data; second, the desired rate equations are fit to this approximated data. As shown in Figure F-1, several techniques were considered for approximating the first derivative. The first considered involved the use of a spline function to fit the (N,a) data; this function is essentially a continuous segmented smooth function whose segments are sets of cubic polynomials. Two types were considered; the first, known as an interpolating spline function, produces a curve that is constrained to pass through each data point. Such a curve would not be desirable for this application, since experimental error could introduce unrealistic inflection points for da/dN . The second type considered involved the use of least squares regression techniques to fit the sets of cubic polynomials. While this technique may have been applicable, it was not investigated because it has only been developed relatively recently and the necessary computer software was not readily available.

The second approximation technique considered involved a segmented least squares approach in which the range of the independent variable (i.e., N) was broken up into three approximately equal intervals. The data in each of the first two



DATA REDUCTION/ANALYSIS TECHNIQUES CONSIDERED FOR CYCLIC TESTING

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intervals (corresponding to low and midrange N values) was fit by a polynomial in a least squares manner with the second polynomial constrained so that the two polynomials would have point and slope continuity at the point between the first and second segments. A rational function $(bN+c)/(N+d)$ constrained to have point and slope continuity with the second polynomial at the point between the second and third segments then fit to the last segment in a least squares manner. A rational function was chosen for the third segment since the magnitude of the crack length values in this range seems to grow as though the desired curve were asymptotically approaching a vertical line. The curve fits using this approach showed too many points of inflection for this segmenting approach to be considered a good mathematical method.

A third approximation technique was considered which involved finding a low order polynomial, p , which passed through the point (N_i, a_i) and was fit in a least squares manner to the points closest to it. The derivative at the point (N_i, a_i) was then computed as:

$$\frac{da_i}{dN_i} = p'(N_i) \quad (F-1)$$

For example, if the flaw growth rate was desired for the sixth point in a series of (N, a) measurements, a low order polynomial passing through the sixth point would be fit in a least squares manner to data points 4, 5, 7, 8 in the data set. The resulting polynomial would be differentiated and then evaluated for the value of (N) at the sixth data point. Although this technique has been used successively for data reduction (Reference F-1), it was not investigated further because other techniques seemed to be more promising.

The fourth approximation technique considered involved LaGrange interpolation. Calculating the derivative using the LaGrange polynomial of second or

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higher degree was considered but not pursued because of the sensitivity of the technique to experimental error. Due to economic restraints and time limitations, a first order approximation (i.e., a simple divided difference) was finally adopted, as described in Section 4.2.1. The data reduction results indicated that this technique probably gives an adequate approximation to the derivative.

Once the first derivative of the (N,a) data was approximated, the resulting rate data had to be fit to the various rate models. Both linear and nonlinear techniques were investigated. The linear techniques involved the use of logarithmic transformations as described in Section 4.2.2; since the use of such transformations can introduce distortions into the analysis, both weighted and unweighted analyses were conducted. For this preliminary analysis, only the Forman rate model, equation (4-3), was investigated. As expressed in equation (4-9), the linearized form of this model is:

$$\ln \left[\frac{da}{dN} \cdot \left\{ (1-R) K_C - \Delta K \right\} \right] = \ln C + n \ln \Delta K \quad (F-2)$$

The unweighted least squares fit of the data to the linearized Forman model yielded values for C and n which resulted in a fairly good fit. However, it was observed that large residual values appeared as the dependent transformed variable in equation (F-2) became large. This effect, shown in Figure F-2, results from the nature of the logarithmic transformation used to linearize equation (4-3). This equation has the form

$$Y = CX^n \quad (F-3)$$

The residual can be expressed as:

$$r_i = CX_i^n - Y_i \quad (F-4)$$

If logarithmic transformations are used, the residual becomes:

$$d_i = (\log C) + n \log X_i - \log Y_i \quad (F-5)$$

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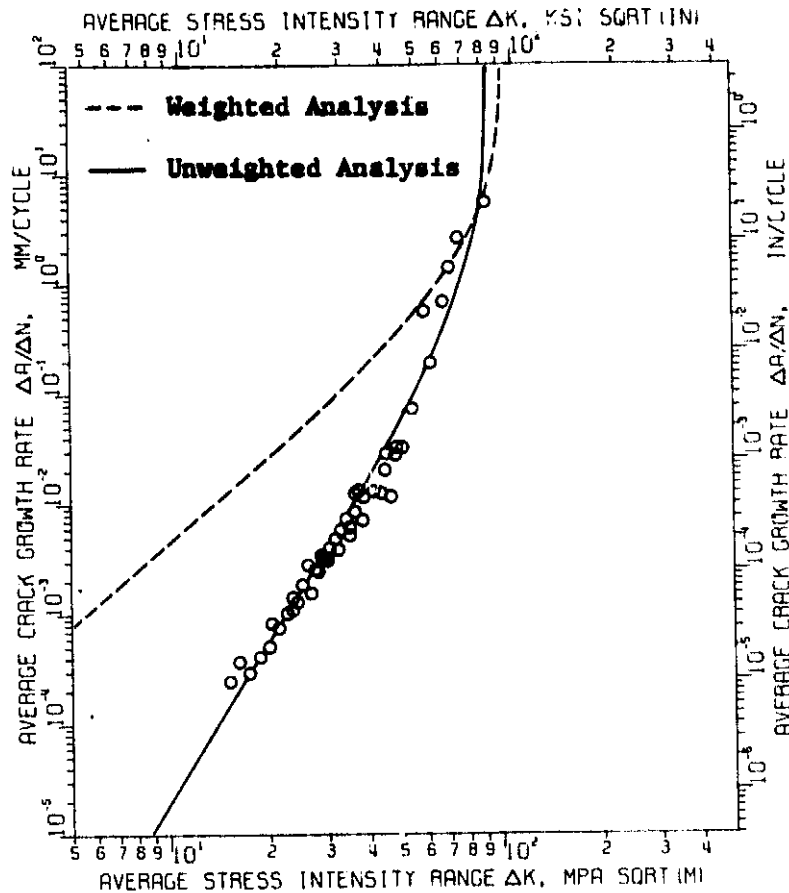


FIGURE F-2

COMPARISON OF WEIGHTED AND UNWEIGHTED LEAST SQUARES ANALYSES OF CYCLIC DATA

(Data from Appendix D, Figure D5-3a)

If $\sum d_i^2$ is minimized, the relative importance of the error for large values of Y is reduced. If Y has a small error ΔY , the error in $\log Y$ has an error roughly equivalent to $\Delta Y/Y$. Therefore,

$$d_i \approx \frac{r_i}{Y_i} \quad (F-6)$$

Minimizing $\sum d_i^2$ is roughly equivalent to minimizing $\sum (r_i/Y_i)^2$. As a result, performing a least squares regression using logarithmic values unintentionally

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weights the error for small values of Y more than that for the larger values. (It has been assumed that X_i contains no error; this not really true, since $X = \Delta K$, and thus contains some experimental error because this term is a function of the crack length, a .)

To weight all errors approximately equally, the quantity

$$\sum Y_i^2 d_i^2$$

must be minimized. This was attempted with the (N_i, a_i) data but the results were not satisfactory because the weights Y_i^2 varied over several orders of magnitude. This resulted in the larger data points completely dominating the remainder of the points in the fitting process. As shown in Figure F-2, the results were predictably poor for the range where the transformed variable, Y_i , was very small although there was reasonable agreement with the curve for the unweighted fit when da/dN was large.

An alternative weighting technique has been suggested (Reference 7-2); it involves the use of a weighting factor equal to the inverse square root of the sum of the squares of the expected errors in $\log (da/dN)$ and $\log (\Delta K)$. To employ this technique, an estimate of error would have to be made for every data point; such a procedure was considered too lengthy for the quantity of data generated under this program.

Nonlinear techniques were also investigated in an attempt to evaluate the parameters associated with equation (4-3) directly, without resorting to logarithmic transformations. In this investigation the value of K_C was also varied using a bisection technique within the least squares program to minimize the sum of the squares of the residuals. The results of this procedure are shown in Figure F-3. Unfortunately, the resulting fit showed poor agreement with the data for the range where da/dN was small. Reasonable agreement was obtained for the larger da/dN values.

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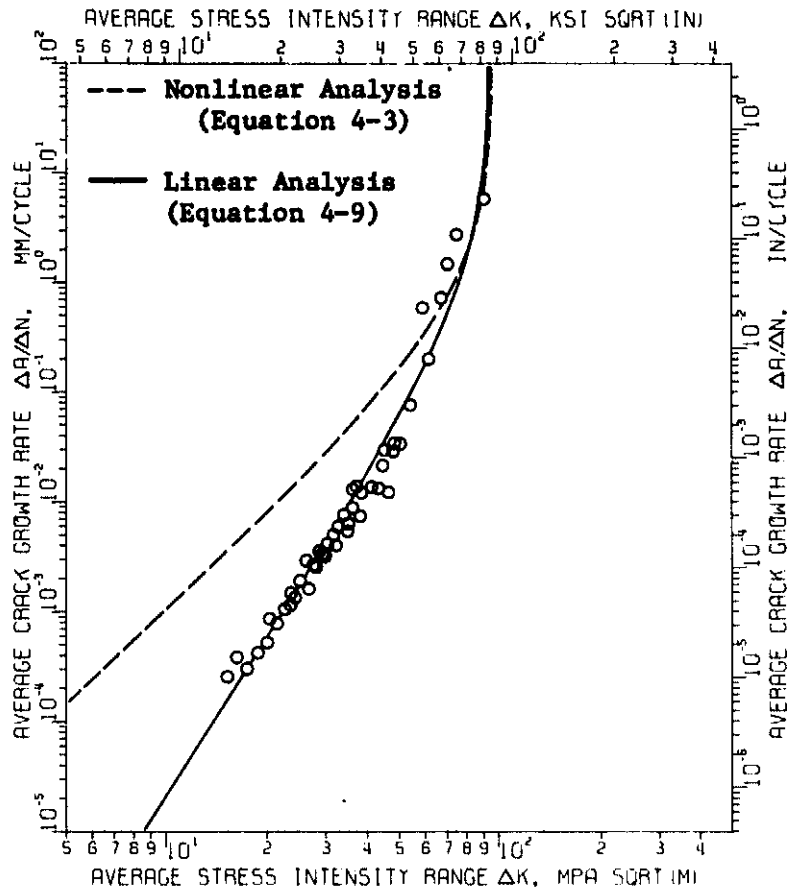


FIGURE F-3

COMPARISON OF LINEAR AND NON-LINEAR LEAST SQUARES ANALYSES OF CYCLIC DATA

(Data from Appendix D, Figure D5-3a)

The two step data reduction/analysis methods described above all introduce unknown amounts of analytical error; each suffers from the following defects:

- o the derivative, da/dN , is approximated and not directly measured, thus introducing analytical error;
- o the error in the "independent" variable, $\log (\Delta K)$, is ignored when the rate equations are linearized; and

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- o the sum of the squares of the errors in the dependent variable (crack length) is not minimized.

These difficulties would be overcome if the integrated form of the rate equations were fit directly to the empirical data. For example, the integrated form of equation (4-3) can be written as:

$$N = \alpha a^{1-m} + \beta a^{1-m} \sqrt{a} + \gamma \quad (F-7)$$

where

$$\alpha = \frac{2(1-R)K_C}{C(2-n)(\Delta\sigma\sqrt{\pi})^n}$$

$$\beta = \frac{-2}{C(3-n)(\Delta\sigma\sqrt{\pi})^{n-1}}$$

$$m = n/2 = [1.5\beta(1-R)K_C + \alpha\Delta\sigma\sqrt{\pi}] / [\beta(1-R)K_C + \alpha\Delta\sigma\sqrt{\pi}] \quad (F-8)$$

$$\Delta\sigma = \sigma_{\max} - \sigma_{\min}$$

γ = constant of integration

Once α , β , γ and m are determined, we can calculate:

$$n = 2m \quad (F-9)$$

$$C = -2/[3-n]\beta(\Delta\sigma\sqrt{\pi})^{n-1} \quad (F-10)$$

$$da/dN = a^m / [(1-m)\alpha + (1.5-m)\beta\sqrt{a}] \quad (F-11)$$

However, calculating α , β , γ , and m directly from the data (N_i, a_i) is a nontrivial problem. The quantity to be minimized is:

$$g = \sum [a_i - h(N_i; \alpha, \beta, \gamma, m)]^2 \quad (F-12)$$

where h is the implicit function $a = h(N)$ defined by equation (F-8). Unfortunately this means that all coefficients α , β , γ , and m appear nonlinearly.

Finding the values of the coefficients which minimize g requires solving the following system of nonlinear equations:

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$$\begin{aligned} \partial g / \partial \alpha &= 2 \sum a_i F_i &= 0 \\ \partial g / \partial \beta &= 2 \sum a_i \sqrt{a_i} F_i &= 0 \\ \partial g / \partial \gamma &= 2 \sum a_i^m F_i &= 0 \\ \partial g / \partial m &= -2 \sum [\alpha + \beta \sqrt{a_i}] [a_i \log a_i] F_i &= 0 \end{aligned} \quad (F-13)$$

where

$$F_i = (a_i - h(N_i; \alpha, \beta, \gamma, m)) / [\alpha(1-m) + \beta(1.5-m)\sqrt{a_i}]$$

From equation (F-9) it is seen that m can be expressed explicitly in terms of α and β so that one equation of system (F-13) is redundant. Nevertheless, solution of the "reduced" system still is a formidable problem. An attempt to numerically solve it for some hypothetical data values showed that unless the starting estimate for the solution was very good, convergence could not be achieved.

The effort required to find a practical method for solving system (F-13) was beyond the scope of this study.

References:

- (F-1) C. E. Feddersen, W. S. Hyler, "Fracture and Fatigue-Crack Propagation Characteristics of 7075-T7351 Aluminum Alloy Sheet and Plate," Battelle Memorial Institute Report No. G8902 (March, 1970).
- (F-2) T. W. Orange, "Some Effects of Experimental Error in Fracture Testing," NASA-TM-X-68285 (August, 1973).

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Appendix G

CONVERSION FACTORS *

<u>TO CONVERT FROM</u>	<u>TO</u>	<u>MULTIPLY BY</u>
Fahrenheit	kelvin	$T_K = (5/9)(T_F + 459.67)$
inch	centimeter	2.54
inch	millimeter	2.54×10^{-1}
kip	kilonewton	4.448221
kip	meganeutron	4.448221×10^3
kip/inch ² (ksi)	megapascal	6.894757
ksi $\sqrt{\text{in}}$	MPa $\sqrt{\text{m}}$	1.099003
lbf	newton	4.448221
lbf/inch ² (psi)	pascal	6.895757×10^3
psi $\sqrt{\text{in}}$	Pa $\sqrt{\text{m}}$	1.099003×10^3

* From: E. A. Mechtly, "The International System of Units", NASA SP-7012, 1973.